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THE HEATING AND VENTILATING MAGAZINE

Vol. XI. No. 3.
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NEW YORK, MARCH, 1914

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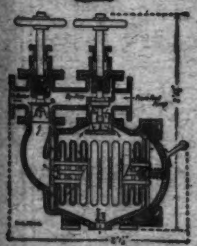

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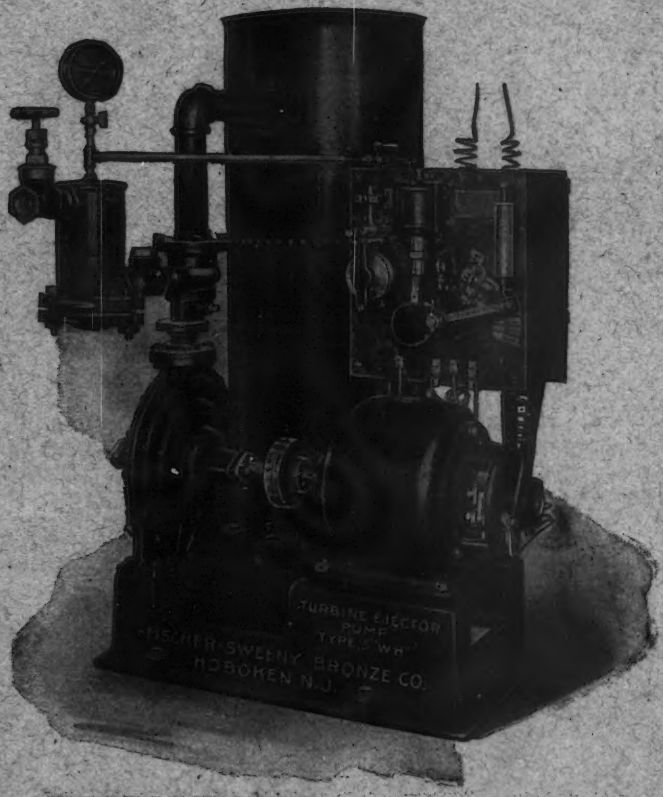

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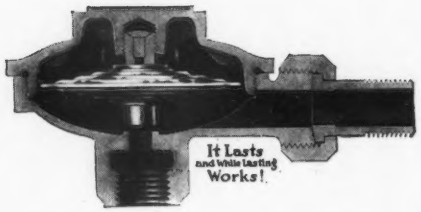

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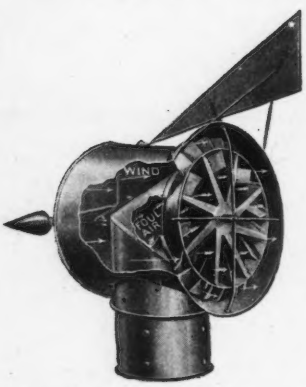
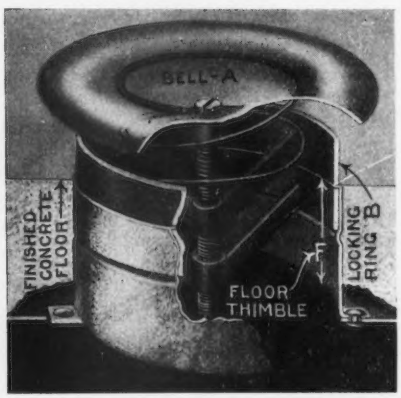


Fan Suction

Power Bills?



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THE HEATING AND VENTILATING MAGAZINE

1123 BROADWAY NEW YORK MARCH, 1914

Ventilation of Engine Rooms

AIR WASHING AND COOLING SYSTEM INSTALLED IN POWER HOUSE OF THE AMERICAN MFG. CO., GREENPOINT, L. I.

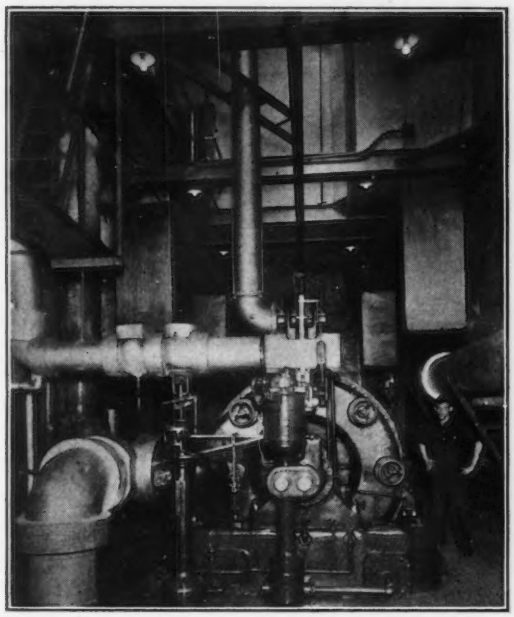
The application of ventilating and air conditioning apparatus to the industries is becoming so well recognized as an economical and effective method of maintaining the efficiency of the workers and, very often, of turning out the product itself, that this field is rapidly coming to assume an importance far in advance of any other one feature of the art. With this advance, the long-suffering engine room workers are at last getting some measure of relief on their own account from the excessive heat conditions that often exist in power plants.

A typical illustration of this condition was that of the engine and turbine rooms of the American Manufacturing Co., at Greenpoint, L. I. Here the temperature in summer often reached 135° F. In the case of the turbine room, the situation was exceptional, due to the fact that the only opening to the outside air is through a skylight, some 40 ft. above the floor. There is a stairway leading up from the floor below but, as the lower floor is occupied as another engine room, the air coming up in that way was equally unbearable.

The conditions called for an air cooling as well as a ventilating system. The solution of the problem is shown in the accompanying illustrations, the entire plant, except motors, being manufactured and installed in four weeks by Wells & Newton Co., of New York, engineers and contractors; Morris S. King being the consulting engineer.

As an indication of the usefulness of the apparatus it is stated that the temperature in both rooms was reduced to approximately 90° F. as a maximum.

The main engine room is on the ground floor of one of the company's main buildings near the East River. Directly



AIR DUCTS IN TURBINE ROOM, AMERICAN MFG. CO.
Door to Fan Room shown at top of photograph.

above the main engine room, at the river end of the building, is the turbine room reached by an iron stairway. The turbine room is on the floor corresponding to the third story of the building.

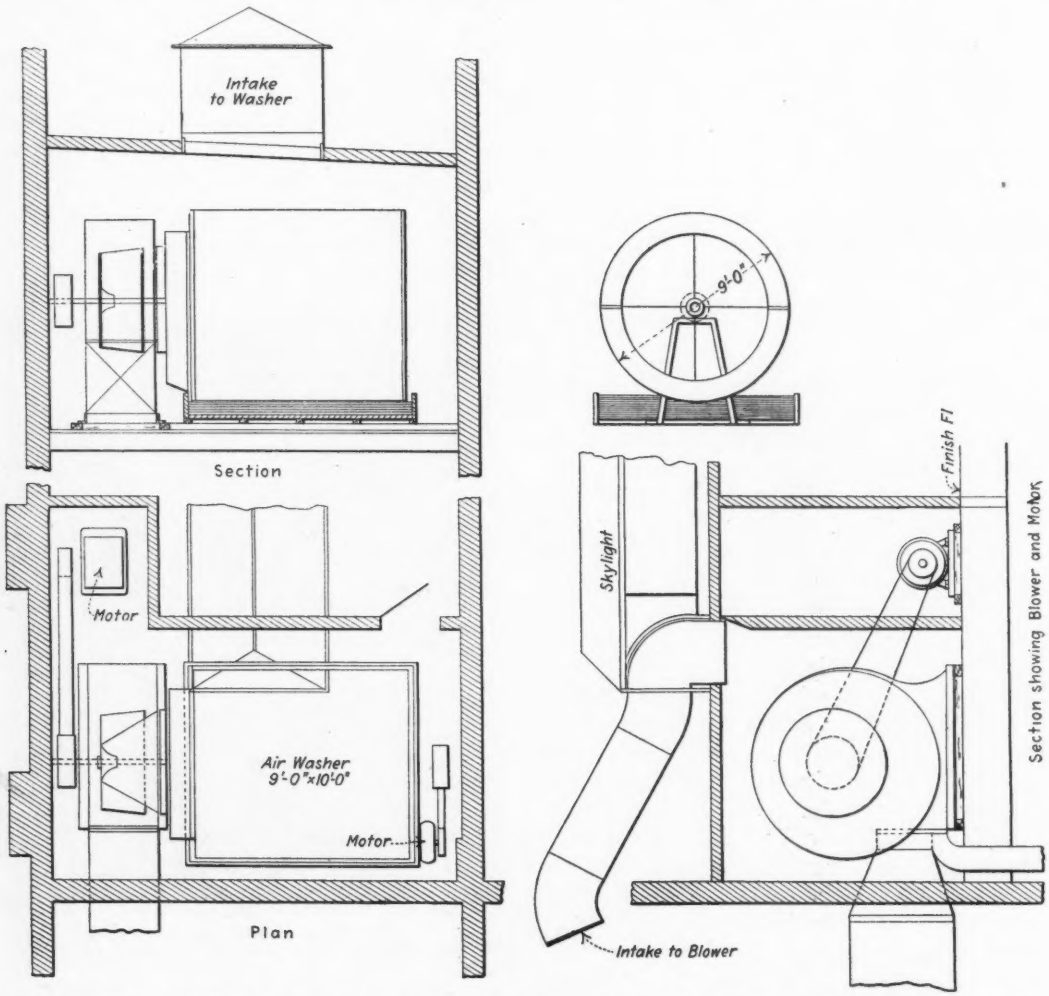
The only available point for the fan and air washer appeared to be at a point above the turbine room and here a fan room was built of brick, some 50 ft. from the ground. The apparatus was installed therein on steel framing and the air is discharged downward in steel ducts to points 8 ft. above the floors of the two rooms.

DESCRIPTION OF APPARATUS.

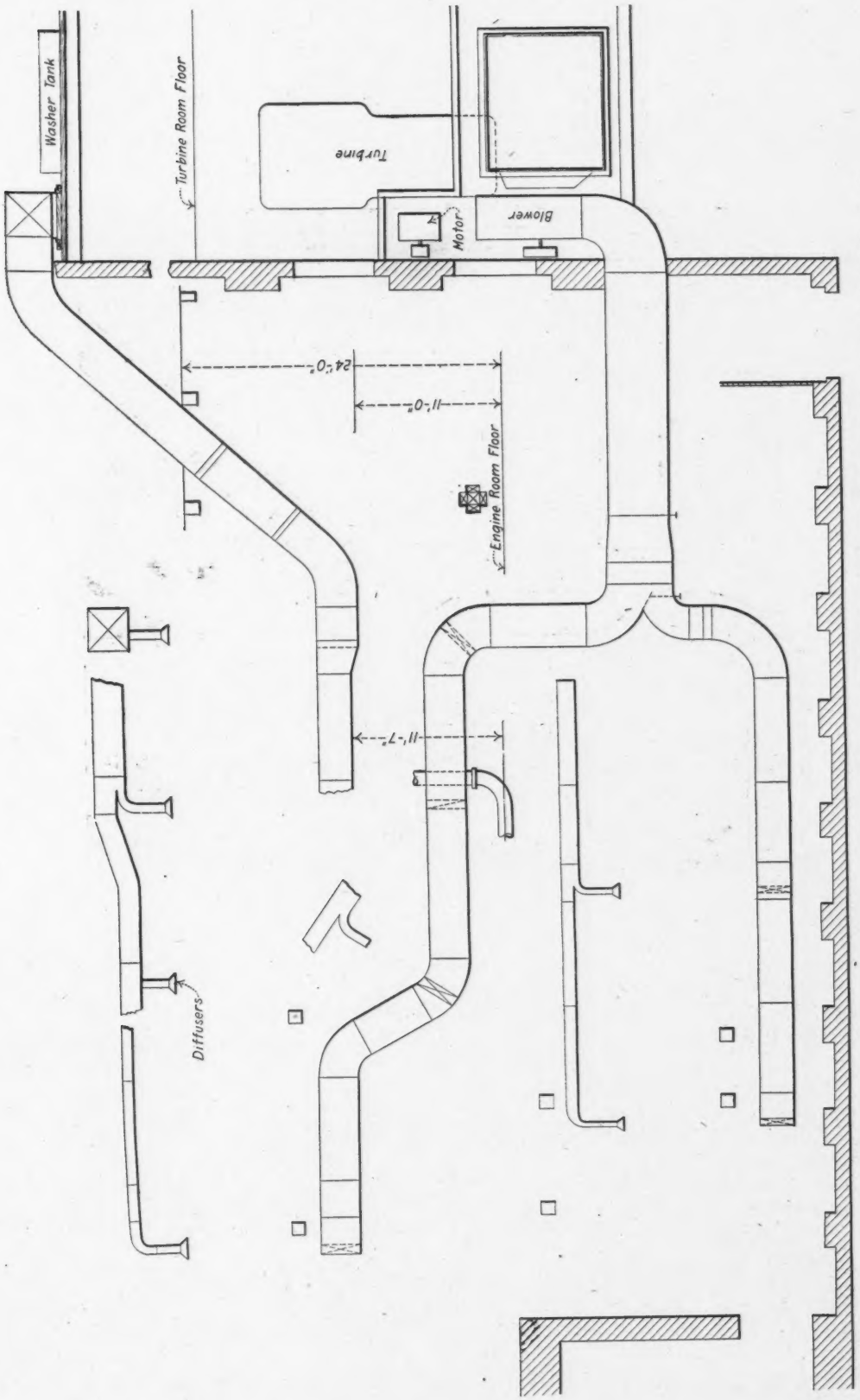
The fresh air is taken from the roof, some 60 ft. from the air washer, this being necessary to secure a fresh supply. The design called for an air change every three minutes, a supply of 57,000 cu. ft. of air per minute.

For this purpose a Keith blower was used, manufactured by the Wells & Newton Co., capable of delivering 60,000 cu. ft. of air per minute, with 1½ oz. pressure at the discharge of fan, the speed of air in the ducts being maintained at 3,000 ft. per minute. The blower is driven by a 30 H. P. motor, belted, of the Sprague Electric Works type, with speed regulator.

The air is delivered to the blower through a Kingwelton air washer, also manufactured by the Wells & Newton Co. This apparatus consists of a revolving drum, encased with an imported fabric. The drum revolves through a water bath at any desired speed. The



FAN ROOM, AMERICAN MFG. CO., GREENPOINT, L. I., SHOWING ARRANGEMENT OF AIR WASHER AND FAN CONNECTIONS.



ARRANGEMENT OF DUCT WORK IN MAIN ENGINE ROOM, AMERICAN MFG. CO., GREENPOINT, L. I.

air is taken through the mesh into the interior of the drum and thence drawn by the blower and sent through the air ducts. In this particular installation, the air washer was made 7 ft. x 15 ft. which permits the passage of air through the washer at a velocity of 460 ft. per minute. It was one of the conditions of the installation that the air washer should remove 98% of all foreign matter passing through same.

AIR DUCTS IN MAIN ENGINE ROOM, AMERICAN MFG. CO., GREENPOINT, L. I.

OTHER FEATURES.

The apparatus was designed so that the temperature of the air at the outlet of the blower would be 80° F. or less, according to outside weather conditions, and this maximum was maintained. At the same time the relative humidity of the incoming air was kept at a point not exceeding 60%. The washer is driven by a 1 H. P. motor, and arranged with speed regulator of the Sprague type.

All ducts were thoroughly insulated, so as to hold the air temperature at the desired degree to the points of delivery. The duct outlets, which, as noted, open downward, are equipped with diffusers and regulating devices, providing for an even distribution. The exhaust outlets are in the form of louvres at the roof of the main engine room, some 30 ft. above the floor.

It might be stated that the apparatus is for use especially in the summer and is distinctly a cooling proposition. Its greatest effectiveness is in the turbine room where the heat effect would be practically unendurable, due to the solid wall construction of this part of the building.

Data for the Heating and Ventilating Engineer

COMPUTATIONS AND METHODS COVERING HEAT LOSSES, FRESH AIR SUPPLY, FAN DESIGN, AIR DUCTS, INDIRECT RADIATORS AND REGISTERS.

By AMZI T. ROGERS.

In connection with the computation of heat losses and fresh air supply [redacted] writer has compiled the accompa[redacted]ators table showing the weight and volume [redacted] air and factors for heat transmission, using as a basis the table given by D. K. Clark. The heat losses here considered are those due to the cooling of air only. Losses by the cooling of walls and glass are computed by the use of coefficients determined by the German government.

The portion of the computation covered by the accompanying table is as follows: To find amount of heat lost by cooling of air at any given range of inside and outside temperatures multiply the number of cubic feet of air in the room by the coefficient found in the column headed "B.T.U. Lost" on the line showing the given temperatures, for each complete change of air required per hour. To find the amount of warm air required to replace this loss divide the result just found by the coefficient found in the column headed "B.T.U. Available," on the line showing the proposed temperature of room and of warm air supply, or multiply by its reciprocal, in the next column.

Example: Suppose the contents of the room to be 8,000 cu. ft., outside air at 0° F., the air to be heated to 130° at the heater, and the room to be maintained at 70°. An allowance of say 10°, depending on the distance the air has to travel from the heater to the discharge register, is made for the cooling of the air in passage, i. e., we will assume in this case the air supply to be heated to 120°. Then: 8,000 x 1.246 = 9,968 B.T. U.; say 10,000 lost per hour by cooling of the air alone.

10,000 x 1.2296 = 12,296, say 12,300 cu. ft. of warm air to be introduced into the room per hour at a temperature of 120° at the register to warm the room to 70° in zero weather.

If the total heat supplied is to be by warm air heated elsewhere and introduced through registers, with no direct radiators, the amount of heat lost by cooling of walls and glass is to be added to that lost by cooling of air alone before finding the amount of warm air required.

The method of determining the heat losses is the same, whatever method may be employed in supplying the heat, and this determination is the first step in the process.

If direct radiation only is to be used, divide the total B. T. U. lost, as just mentioned, by the number of B. T. U. given off per hour per square feet by the form of radiating surface proposed at the given range of temperatures between the radiator and the heated room. This gives the number of square feet of radiating surface required.

When both direct and indirect radiators are used, the proportion of each form of heating surface generally used is as follows:

Provide direct radiators of the right amount to restore the heat lost by cooling of walls and glass, and indirect radiators to heat the air required for ventilation and to supply the heat lost by cooling of the air. The number of occupants, the temperature required and the purpose for which the room is to be used will cause some variation in the relative proportions of direct and indirect radiation.

There is also an advantage in the combined system in the ability to maintain at least a moderate degree of heat in the rooms over night or during holidays, etc., by the circulation of steam or water at a moderate temperature through the direct radiators when change of air is not necessary, and when the expense and attention incident to the running of fans may be obviated.

SUGGESTIONS FOR DESIGN OF FAN.

To determine the size of fan required

WEIGHT AND VOLUME OF AIR AND FACTORS FOR HEAT TRANSMISSION.

Temp. Deg. F.	Weight per Cu.Ft.	Cu. Ft. per Pound.	Temperature Deg. F. Out	In	Diff.	B. T. U. Lost per Cubic Ft.	Temperature Deg. F. Room	Supply	Diff.	B. T. U. Available per Cubic Foot.	Reciprocal	Temperature Deg. F. Room	Supply	Diff.	B. T. U. Available per Cubic Foot.	Reciprocal
50	0.077884	12.8396	0	50	50	0.9249	50	120	70	1.1388	0.8781	50	80	30	0.5237	1.9096
55	0.077132	12.9648	0	55	55	1.0075	55	120	65	1.0575	0.9457	55	80	25	0.4364	2.2915
60	0.076394	13.0900	0	60	60	1.0886	60	120	60	0.9761	1.0245	60	80	20	0.3491	2.8644
65	0.075666	13.2160	0	65	65	1.1681	65	120	55	0.8948	1.1176	65	80	15	0.2619	3.8195
70	0.074950	13.3422	0	70	70	1.2460	70	120	50	0.8134	1.2296	70	80	10	0.1746	5.7287
75	0.074250	13.4680	0	75	75	1.3266	75	120	45	0.7321	1.3659	75	80	5	0.0873	11.4576
80	0.073565	13.5934	0	80	80	1.3977	80	120	40	0.6508	1.5367	--	--	--	------	-------
85	0.072892	13.7190	-5	50	55	1.0174	50	130	80	1.2799	0.7813	50	90	40	0.6862	1.4573
90	0.072230	13.8447	-5	55	60	1.0991	55	130	75	1.1999	0.8334	55	90	35	0.6004	1.6655
100	0.070942	14.0960	-5	65	70	1.2579	65	130	65	1.0399	0.9616	65	90	25	0.4289	2.3317
105	0.070331	14.2184	-5	70	75	1.3951	70	130	60	0.9599	1.0418	70	90	20	0.3431	2.9147
110	0.069721	14.3429	-5	75	80	1.4107	75	130	55	0.8799	1.1364	75	90	15	0.2573	3.8865
115	0.069111	14.4694	-5	80	85	1.4851	80	130	50	0.7999	1.2501	80	90	10	0.1715	5.8293
120	0.068500	14.5983	-10	50	60	1.1098	50	140	90	1.4155	0.7065	50	100	50	0.8424	1.1870
125	0.067930	14.7210	-10	55	65	1.1907	55	140	85	1.3368	0.7480	55	100	45	0.7582	1.3190
130	0.067361	14.8454	-10	60	70	1.2700	60	140	80	1.2582	0.7948	60	100	40	0.6734	1.4838
135	0.066791	14.9721	-10	65	75	1.3478	65	140	75	1.1796	0.8478	65	100	35	0.5897	1.6958
140	0.066221	15.1009	-10	70	80	1.4240	70	140	70	1.1009	0.9083	70	100	30	0.5055	1.9784
145	0.065680	15.2250	-10	75	85	1.4989	75	140	65	1.0223	0.9782	75	100	25	0.4212	2.3140
150	0.065155	15.3510	-10	80	90	1.5725	80	140	60	0.9436	1.0597	80	100	20	0.3370	2.9676
			-15	50	65	1.2023	50	150	100	1.5474	0.6462	50	110	60	0.9935	1.0065
			-15	55	70	1.2823	55	150	95	1.4700	0.6802	55	110	55	0.9107	1.0980
			-15	60	75	1.3608	60	150	90	1.3927	0.7180	60	110	50	0.8279	1.2078
			-15	65	80	1.4377	65	150	85	1.3153	0.7603	65	110	45	0.7451	1.3420
			-15	70	85	1.5130	70	150	80	1.2380	0.8078	70	110	40	0.6623	1.5098
			-15	75	90	1.5867	75	150	75	1.1606	0.8616	75	110	35	0.5796	1.7254
			-15	80	95	1.6598	80	150	70	1.0832	0.9232	80	110	30	0.4968	2.0130

in an indirect system, find the total amount of air necessary at the given temperature to supply the heat for all the rooms to be heated, as explained above, and select a fan capable of delivering that amount of air at the assumed velocity, and pressure.

The fan should be large enough to deliver the air at a comparatively low velocity for the power thus required will be much less than if a small fan is used at a high velocity.

As the resistance, and therefore the power required and the liability to slip, increases as the square of the velocity, it is readily seen that with a comparatively low speed of the fan, with large ducts, the amount of air moved usefully will be more nearly in accordance with the economical capacity of the fan than with a higher velocity. Any saving in first cost by installing a small fan will be eaten up and more by the reduced efficiency and higher cost of operation at the higher speed necessary. The loss by friction in proportion to capacity is less in large ducts, at low speed, than in small ducts at high speed.

Of course,, circumstances, such as lack of sufficient space, etc., may preclude the possibility of using a large, slow-speed fan, yet it might be a saving in the end to go to considerable expense to provide the space. A fan will run more quietly at low speed than at high speed which also conduces to comfort of occupants of the building.

If an electric motor is used, a belted motor is better than direct-connected, because a high speed motor with smaller pulley and armature and giving a smaller output of power per revolution, can be built at less cost with standard details, and will require less space than a low speed motor having a larger armature, special winding, and giving more power per revolution.

If steam power is used, a direct-connected engine may be aranged to give the proper speed as readily as a belted connection and will require less space. A steam engine, unless in the turbine form, will require more space than an electric motor, but the exhaust steam may be used in the heater, thus reducing the cost of operation.

Notes on Accompanying Table.

To find loss of heat due to cooling of air in room, multiply the number of cubic feet in room by coefficient found in column headed "B. T. U. Lost per Cubic Foot" on line showing given indoor and outdoor temperatures.

To find amount of warm air required to maintain desired temperature of room, add above result to heat lost by cooling of outside walls and glass, computed by other coefficients. Divide this sum by coefficient found in column headed, "B. T. U. Available" on line showing given temperature of room and supply, or multiply by coefficient on same line in following column headed "Reciprocal."

Where exhaust fans are used. the amount of air to be removed is proportional to the number of occupants of rooms. This is usually assumed at a certain number of square feet of floor area per person, varying according to use of rooms, as follows:

VENTILATION.

	Square Feet.	Cubic Feet Per Hour.
Offices	50	1,800
Restaurants ..	20	1,800
Court and Legislative Rooms	15-20	2,000
Waiting Rooms	30	1,800
Drug Stores..	35	1,800
Department Stores	10	1,800
Toilets	15	1,800
Schools	18	1,800-2,000
Churches	15	1,500-2,000
Theatres, Etc.	15	1,500-1,800
Residences ...	100	1,800
Hospitals	60	4,000
Hospitals (contagious) ...	60	6,000

The amount of air, total, to be removed varies as in the second column.

LEAKAGE.

Some air will leak out around windows, doors, etc. At a velocity of entering air at, say 300 ft. per minute, we may assume average leakage space to equal 1/16-in. wide x periphery in feet of windows and doors. Reducing all factors, leakage in cubic feet equals periphery in feet x 93.75. Assume ——— cu. ft. of air escaping at each time an ordinary size door is opened.

above the main engine room, at the river end of the building, is the turbine room reached by an iron stairway. The turbine room is on the floor corresponding to the third story of the building.

The only available point for the fan and air washer appeared to be at a point above the turbine room and here a fan room was built of brick, some 50 ft. from the ground. The apparatus was installed therein on steel framing and the air is discharged downward in steel ducts to points 8 ft. above the floors of the two rooms.

DESCRIPTION OF APPARATUS.

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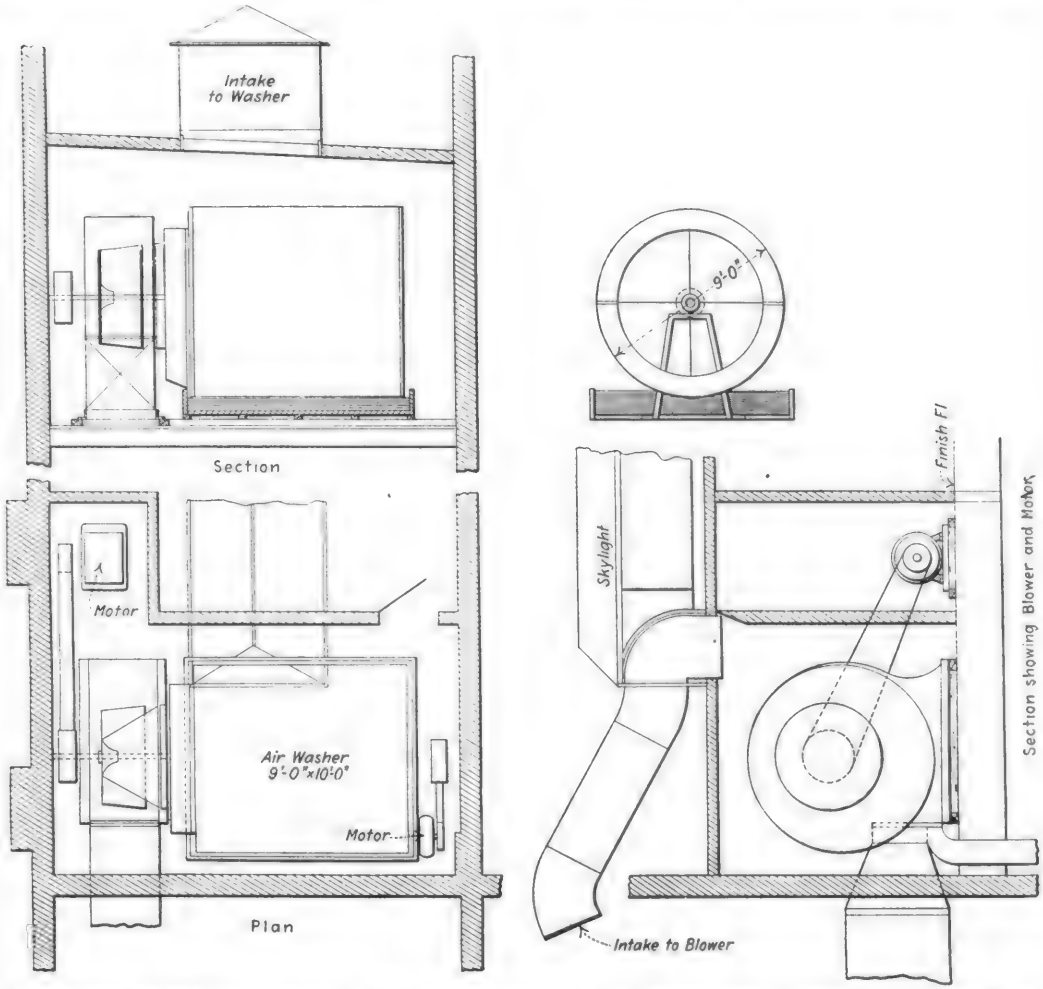
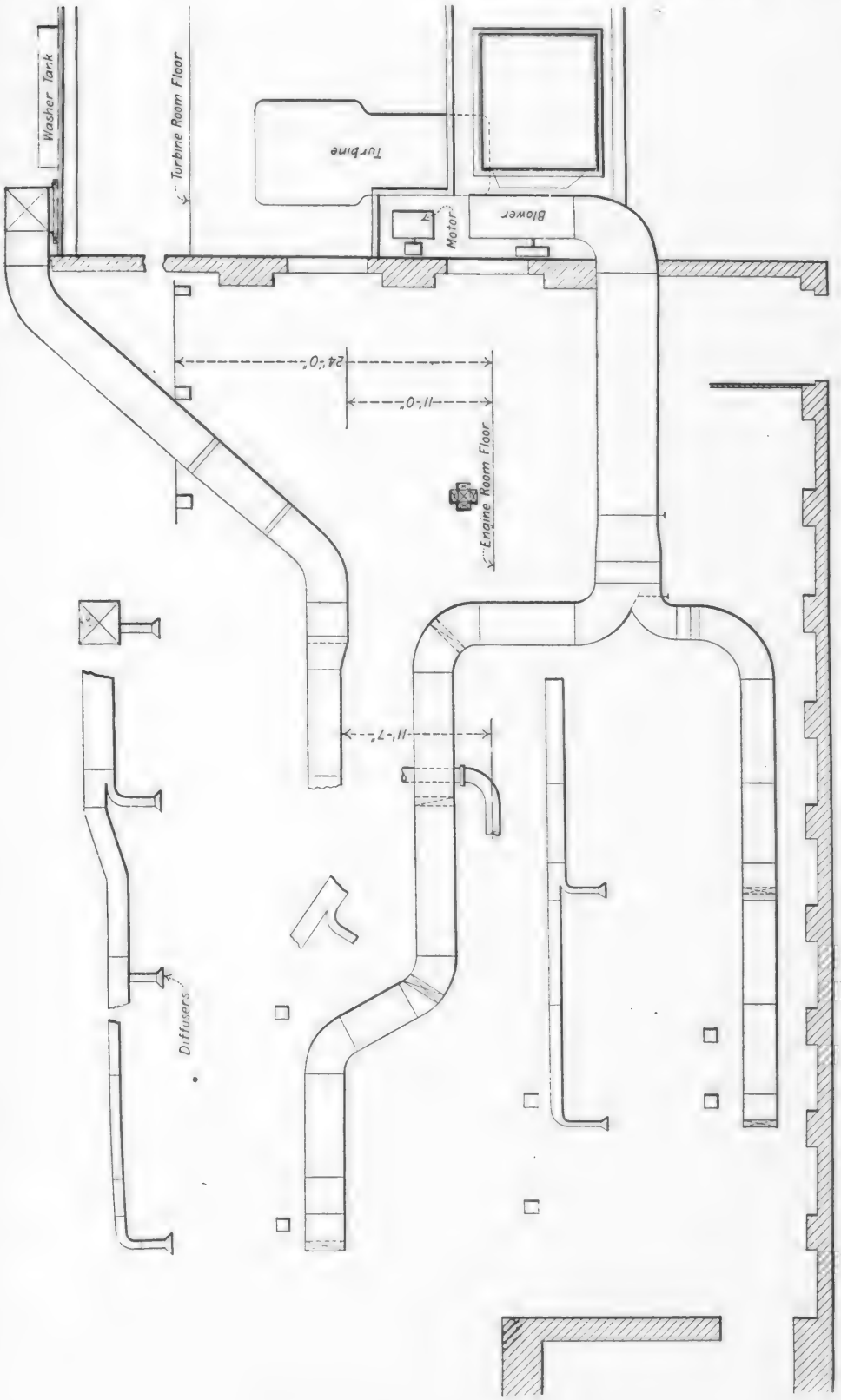
For this purpose a Keith blower was used, manufactured by the Wells & Newton Co., capable of delivering 60,000 cu. ft. of air per minute, with 1½ oz. pressure at the discharge of fan, the speed of air in the ducts being maintained at 3,000 ft. per minute. The blower is driven by a 30 H. P. motor, belted, of the Sprague Electric Works type, with speed regulator.

The air is delivered to the blower through a Kingwelton air washer, also manufactured by the Wells & Newton Co. This apparatus consists of a revolving drum, encased with an imported fabric. The drum revolves through a water bath at any desired speed. The



FAN ROOM, AMERICAN MFG. CO., GREENPOINT, L. I., SHOWING ARRANGEMENT OF AIR WASHER AND FAN CONNECTIONS.



ARRANGEMENT OF DUCT WORK IN MAIN ENGINE ROOM, AMERICAN MFG. CO., GREENPOINT, L. I.

air is taken through the mesh into the interior of the drum and thence drawn by the blower and sent through the air ducts. In this particular installation, the air washer was made 7 ft. x 15 ft. which permits the passage of air through the washer at a velocity of 460 ft. per minute. It was one of the conditions of the installation that the air washer should remove 98% of all foreign matter passing through same.

OTHER FEATURES.

The apparatus was designed so that the temperature of the air at the outlet of the blower would be 80° F. or less, according to outside weather conditions, and this maximum was maintained. At the same time the relative humidity of the incoming air was kept at a point not exceeding 60%. The washer is driven by a 1 H. P. motor, and arranged with speed regulator of the Sprague type.

All ducts were thoroughly insulated, so as to hold the air temperature at the desired degree to the points of delivery. The duct outlets, which, as noted, open downward, are equipped with diffusers and regulating devices, providing for an even distribution. The exhaust outlets are in the form of louvres at the roof of the main engine room, some 30 ft. above the floor.

AIR DUCTS IN MAIN ENGINE ROOM, AMERICAN MFG. CO., GREENPOINT, L. I.

It might be stated that the apparatus is for use especially in the summer and is distinctly a cooling proposition. Its greatest effectiveness is in the turbine room where the heat effect would be practically unendurable, due to the solid wall construction of this part of the building.

Data for the Heating and Ventilating Engineer

COMPUTATIONS AND METHODS COVERING HEAT LOSSES, FRESH AIR SUPPLY, FAN DESIGN, AIR DUCTS, INDIRECT RADIATORS AND REGISTERS.

By AMZI T. ROGERS.

In connection with the computation of heat losses and fresh air supply, the writer has compiled the accompanying table showing the weight and volume of air and factors for heat transmission, using as a basis the table given by D. K. Clark. The heat losses here considered are those due to the cooling of air only. Losses by the cooling of walls and glass are computed by the use of coefficients determined by the German government.

The portion of the computation covered by the accompanying table is as follows: To find amount of heat lost by cooling of air at any given range of inside and outside temperatures multiply the number of cubic feet of air in the room by the coefficient found in the column headed "B.T.U. Lost" on the line showing the given temperatures, for each complete change of air required per hour. To find the amount of warm air required to replace this loss divide the result just found by the coefficient found in the column headed "B.T.U. Available," on the line showing the proposed temperature of room and of warm air supply, or multiply by its reciprocal, in the next column.

Example: Suppose the contents of the room to be 8,000 cu. ft., outside air at 0° F., the air to be heated to 130° at the heater, and the room to be maintained at 70°. An allowance of say 10°, depending on the distance the air has to travel from the heater to the discharge register, is made for the cooling of the air in passage, i. e., we will assume in this case the air supply to be heated to 120°. Then: 8,000 x 1.246 = 9,968 B.T. U.; say 10,000 lost per hour by cooling of the air alone.

10,000 x 1.2296 = 12,296, say 12,300 cu. ft. of warm air to be introduced into the room per hour at a temperature of 120° at the register to warm the room to 70° in zero weather.

If the total heat supplied is to be by warm air heated elsewhere and introduced through registers, with no direct radiators, the amount of heat lost by cooling of walls and glass is to be added to that lost by cooling of air alone before finding the amount of warm air required.

The method of determining the heat losses is the same, whatever method may be employed in supplying the heat, and this determination is the first step in the process.

If direct radiation only is to be used, divide the total B. T. U. lost, as just mentioned, by the number of B. T. U. given off per hour per square feet by the form of radiating surface proposed at the given range of temperatures between the radiator and the heated room. This gives the number of square feet of radiating surface required.

When both direct and indirect radiators are used, the proportion of each form of heating surface generally used is as follows:

Provide direct radiators of the right amount to restore the heat lost by cooling of walls and glass, and indirect radiators to heat the air required for ventilation and to supply the heat lost by cooling of the air. The number of occupants, the temperature required and the purpose for which the room is to be used will cause some variation in the relative proportions of direct and indirect radiation.

There is also an advantage in the combined system in the ability to maintain at least a moderate degree of heat in the rooms over night or during holidays, etc., by the circulation of steam or water at a moderate temperature through the direct radiators when change of air is not necessary, and when the expense and attention incident to the running of fans may be obviated.

SUGGESTIONS FOR DESIGN OF FAN.

To determine the size of fan required

WEIGHT AND VOLUME OF AIR AND FACTORS FOR HEAT TRANSMISSION.

Temp. Deg. F.	Weight per Cu.Ft.	Cu. Ft. per Pound.	Temperature Deg. F. Out	In	Diff.	B. T. U. Lost per Cubic Ft.	Temperature Deg. F. Room	Supply	Diff.	B. T. U. Available per Cubic Foot.	Reciprocal	Temperature Deg. F. Room	Supply	Diff.	B. T. U. Available per Cubic Foot.	Reciprocal
50	0.077884	12.8396	0	50	50	0.9249	50	120	70	1.1388	0.8781	50	80	30	0.5237	1.9096
55	0.077132	12.9648	0	55	55	1.0075	55	120	65	1.0575	0.9457	55	80	25	0.4364	2.2915
60	0.076394	13.0900	0	60	60	1.0886	60	120	60	0.9761	1.0245	60	80	20	0.3491	2.8644
65	0.075666	13.2160	0	65	65	1.1681	65	120	55	0.8948	1.1176	65	80	15	0.2619	3.8195
70	0.074950	13.3422	0	70	70	1.2460	70	120	50	0.8134	1.2296	70	80	10	0.1746	5.7287
75	0.074250	13.4680	0	75	75	1.3266	75	120	45	0.7321	1.3659	75	80	5	0.0873	11.4576
80	0.073565	13.5934	0	80	80	1.3977	80	120	40	0.6508	1.5367	--	--	--	------	-------
85	0.072892	13.7190	-5	50	55	1.0174	50	130	80	1.2799	0.7813	50	90	40	0.6862	1.4573
90	0.072230	13.8447	-5	55	60	1.0991	55	130	75	1.1999	0.8334	55	90	35	0.6004	1.6655
100	0.070942	14.0960	-5	65	70	1.2579	65	130	65	1.0399	0.9616	65	90	25	0.4289	2.3317
105	0.070331	14.2184	-5	70	75	1.3951	70	130	60	0.9599	1.0418	70	90	20	0.3431	2.9147
110	0.069721	14.3429	-5	75	80	1.4107	75	130	55	0.8799	1.1364	75	90	15	0.2573	3.8865
115	0.069111	14.4694	-5	80	85	1.4851	80	130	50	0.7999	1.2501	80	90	10	0.1715	5.8293
120	0.068500	14.5983	-10	50	60	1.1098	50	140	90	1.4155	0.7065	50	100	50	0.8424	1.1870
125	0.067930	14.7210	-10	55	65	1.1907	55	140	85	1.3368	0.7480	55	100	45	0.7582	1.3190
130	0.067361	14.8454	-10	60	70	1.2700	60	140	80	1.2582	0.7948	60	100	40	0.6734	1.4838
135	0.066791	14.9721	-10	65	75	1.3478	65	140	75	1.1796	0.8478	65	100	35	0.5897	1.6958
140	0.066221	15.1009	-10	70	80	1.4240	70	140	70	1.1009	0.9083	70	100	30	0.5055	1.9784
145	0.065680	15.2250	-10	75	85	1.4989	75	140	65	1.0223	0.9782	75	100	25	0.4212	2.3140
150	0.065155	15.3510	-10	80	90	1.5725	80	140	60	0.9436	1.0597	80	100	20	0.3370	2.9676
			-15	50	65	1.2023	50	150	100	1.5474	0.6462	50	110	60	0.9935	1.0065
			-15	55	70	1.2823	55	150	95	1.4700	0.6802	55	110	55	0.9107	1.0980
			-15	60	75	1.3606	60	150	90	1.3927	0.7180	60	110	50	0.8279	1.2078
			-15	65	80	1.4377	65	150	85	1.3153	0.7603	65	110	45	0.7451	1.3420
			-15	70	85	1.5130	70	150	80	1.2380	0.8078	70	110	40	0.6623	1.5098
			-15	75	90	1.5867	75	150	75	1.1606	0.8616	75	110	35	0.5796	1.7254
			-15	80	95	1.6598	80	150	70	1.0832	0.9232	80	110	30	0.4968	2.0130

in an indirect system, find the total amount of air necessary at the given temperature to supply the heat for all the rooms to be heated, as explained above, and select a fan capable of delivering that amount of air at the assumed velocity, and pressure.

The fan should be large enough to deliver the air at a comparatively low velocity for the power thus required will be much less than if a small fan is used at a high velocity.

As the resistance, and therefore the power required and the liability to slip, increases as the square of the velocity, it is readily seen that with a comparatively low speed of the fan, with large ducts, the amount of air moved usefully will be more nearly in accordance with the economical capacity of the fan than with a higher velocity. Any saving in first cost by installing a small fan will be eaten up and more by the reduced efficiency and higher cost of operation at the higher speed necessary. The loss by friction in proportion to capacity is less in large ducts, at low speed, than in small ducts at high speed.

Of course,, circumstances, such as lack of sufficient space, etc., may preclude the possibility of using a large, slow-speed fan, yet it might be a saving in the end to go to considerable expense to provide the space. A fan will run more quietly at low speed than at high speed which also conduces to comfort of occupants of the building.

If an electric motor is used, a belted motor is better than direct-connected, because a high speed motor with smaller pulley and armature and giving a smaller output of power per revolution, can be built at less cost with standard details, and will require less space than a low speed motor having a larger armature, special winding, and giving more power per revolution.

If steam power is used, a direct-connected engine may be aranged to give the proper speed as readily as a belted connection and will require less space. A steam engine, unless in the turbine form, will require more space than an electric motor, but the exhaust steam may be used in the heater, thus reducing the cost of operation.

Notes on Accompanying Table.

To find loss of heat due to cooling of air in room, multiply the number of cubic feet in room by coefficient found in column headed "B. T. U. Lost per Cubic Foot" on line showing given indoor and outdoor temperatures.

To find amount of warm air required to maintain desired temperature of room, add above result to heat lost by cooling of outside walls and glass, computed by other coefficients. Divide this sum by coefficient found in column headed, "B. T. U. Available" on line showing given temperature of room and supply, or multiply by coefficient on same line in following column headed "Reciprocal."

Where exhaust fans are used. the amount of air to be removed is proportional to the number of occupants of rooms. This is usually assumed at a certain number of square feet of floor area per person, varying according to use of rooms, as follows:

VENTILATION.

	Square Feet.	Cubic Feet Per Hour.
Offices	50	1,800
Restaurants ..	20	1,800
Court and Legislative Rooms	15-20	2,000
Waiting Rooms	30	1,800
Drug Stores..	35	1,800
Department Stores	10	1,800
Toilets	15	1,800
Schools	18	1,800-2,000
Churches	15	1,500-2,000
Theatres, Etc.	15	1,500-1,800
Residences ...	100	1,800
Hospitals	60	4,000
Hospitals (contagious) ...	60	6,000

The amount of air, total, to be removed varies as in the second column.

LEAKAGE.

Some air will leak out around windows, doors, etc. At a velocity of entering air at, say 300 ft. per minute, we may assume average leakage space to equal 1/16-in. wide x periphery in feet of windows and doors. Reducing all factors, leakage in cubic feet equals periphery in feet x 93.75. Assume ——— cu. ft. of air escaping at each time an ordinary size door is opened.

The most economical speed for an electric motor is much higher than that of a blower fan, such as is used in most heating and ventilating plants, the former ranging from say 1,800 to 2,000 R. P. M. for small motors of 2 or 3 H. P. required for a 40-in. or 50-in. fan, to 500 or 600 R. P. M. for a 50 H. P. motor required for a 200-in. fan. The usual speeds for fans range from say 600 to 800 R. P. M. for a 40-in. fan to 150 to 175 R. P. M. for a 200-in. fan, delivering air at 1 oz. pressure in each case. For ordinary ventilation work the pressure is seldom more than this, and is often less, unless in cases involving unusually long ducts with many bends, requiring greater pressure to overcome the increased friction. And even in such cases the usual practice in ordinary offices or public buildings is to figure the fan and ducts of sufficient size to deliver the necessary amount of air at a pressure of 1 oz. or less. In many buildings the positions of the registers are such that a high velocity of air through them would be very objectionable, causing unpleasant drafts, and the best results are obtained when the pressure at the fan is not over 1 oz., with a velocity through the registers of not over 150 ft. to 300 ft. per minute. The friction of a long duct acts to reduce the velocity and pressure towards the farther extremity, the loss of pressure being taken up in the elasticity or compressibility of the air.

DIFFERENT CONDITIONS IN FACTORIES.

In large factories or mercantile buildings, where the number of occupants is less in proportion to space, higher pressures and velocities are used, with fewer discharge outlets, and without registers. Here the warm air is usually discharged at such height above the floor that it will not come with unpleasant force into the workmen's faces, a lower room temperature being also allowable than in offices, etc., where occupants are sitting or at sedentary occupations. The higher velocity of air and greater altitude of discharge above the floor, and the smaller number of outlets permit of the introduction of air at a higher temperature and its projection to a greater distance from the outlets, thus heating the room sufficiently at less expense for ducts than in ordinary heating.

Blacksmith shops, planing mills and other buildings where operations are carried on in which much dust or obnoxious gases are produced require special treatment, with abundance of positive exhausting power to remove these injurious products.

PROPORTIONING AIR DUCTS.

In proportioning sizes of air ducts, both for heating and exhaust air, the velocity usually assumed in the flues leading to the individual registers is 400 to 600 ft. per minute, and through the registers 150 to 300 ft. per minute. It is not so important, however, to secure a low velocity through the exhaust registers, for the motion of air towards the outlet is not so objectionable as motion of air projected into the room.

This velocity through the registers is for the net free area, which for the average cast-iron register is about two-thirds the nominal size. The obstruction of a plain wire screen is less than this, but in most cases for the inlet of warm air it is required to control the amount of air by louvres, and the faces of registers containing louvres seldom have more than 66 per cent. or 70 per cent. free area.

Knowing from computations explained earlier in this article the amount of air necessary to be supplied, we can determine the sizes of the ducts and registers by dividing the number of cubic feet of air to be supplied per minute by the velocity of air in feet per minute in each case, and multiplying the quotient by 144, which gives the sectional area of the duct or register in square inches. The shape of the flue should for ease of delivery be as nearly square as possible, or better yet if it could be round. In most cases, however, a round flue as a riser in a building will take up more space than is allowable, and a rectangular flue can be stowed more easily in the space available. A rectangular flue should have somewhat greater actual area than a round flue for the same amount of air delivered, say the next commercial size or two on account of the greater frictional surface in proportion to area.

The size of the main duct at the fan is determined by the size of the fan outlet, the size of fan being selected to deliver the required amount of air at the pro-

posed pressure, usually ½ to 1 oz. The velocity of the air at this point is then determined by dividing the number of cubic feet of air to be delivered per minute by the area of the outlet in square feet.

The most usual velocity at the fan outlet will be 1,800 to 2,500 feet per minute, according to the pressure used; the pressure usually being greater in large plants and lower in smaller plants. As branches are taken off the velocity will be reduced gradually to about 400 to 600 feet per minute just before reaching the registers, as mentioned above. The graduation of velocities is assumed according to conditions, sizes of ducts being computed at these velocities.

Tables and charts have been prepared giving sizes of flues and velocities required for various amounts of air discharged per minute for different lengths of pipe, and varying pressures, allowing for friction due to length of ducts, number and degree of bends, etc., and some of these are no doubt fairly reliable, but the writer considers the method he has just previously described very simple and reliable. Good judgment is required with any method.

A pipe carrying a large amount of air can be relatively smaller than one carrying a small amount both because of the relatively smaller frictional surface, and because such a pipe is more often nearer to the fan than a smaller one, joining the main at a point having higher velocity. The fewer the number of branches, the greater will be the reduction in velocity at each branch.

By the use of odd or fractional sizes of pipe and by very exact calculation of sizes, with careful and exact allowance for the variation in friction losses due to difference in size, shape and lengths of pipe and number and sharpness of bends, and by throttling the throat of the branch accordingly, it is possible to distribute the delivery very nearly as desired, yet the flow of air is so easily influenced by many little details difficult to foresee and to positively and correctly provide for, that the exact calculation and rigid construction of every branch outlet would be commercially impracticable. The work is also very likely not to be put in exactly as originally planned, either because of inaccuracy of workmen, or more often because the piping plans are made with sufficient accuracy of detail, and bends, offsets and variations in shape and size of piping are found necessary where not shown on plans or sometimes those shown may be omitted. Therefore much time and expense may usually be saved and final accuracy be gained by figuring to the nearest commercial or convenient size and making final and accurate adjustments according to amounts of air actually delivered. Branches should leave the main at an easy deflection, curves being better than angular bends, and at not more than 45° with main.

FIGURING INDIRECT HEATING SURFACE.

To determine the amount of indirect radiating surface necessary to heat the above amount of air through the given range of temperature (usually 0° to 130° or 140° F.) divide the number of B. T. U. lost by cooling of air, walls and glass, as explained before, by the number of B. T. U. given off per square foot per hour by the form of radiation proposed at the given range of temperature between cold and heated air (0° to 130°), at the proposed radiator temperature, say 228° F. or 5 lbs. steam pressure. This will ordinarily range from 600 B. T. U. to 1,200 B. T. U. under the above conditions, depending on the velocity of the air and the arrangement of radiating surfaces, also on the completeness of removal of air within the steam space giving the steam actual contact with all the radiating surface.

A value for this coefficient of heat emission formerly frequently used, is 600 B. T. U. emitted per square foot per hour with a velocity of air of about 900 feet per minute. With improved design and arrangement of radiating surface a coefficient as high as 1,400 B. T. U. has been claimed, and it is probable that under good average conditions with this surface 800 to 1,000 or possibly 1,200 B. T. U. per square foot per hour would be a safe value. The amount of actual definite knowledge we have on this subject is comparatively meager. While a number of experiments have been made, most of the knowledge we have is the sum of general results from actual practice.

It is undoubtedly more economical in operation, and this wil bear frequent repeating, to have at least a slight surplus in capacity, especially in boiler power, so that in very cold weather, or in locations unusually exposed or difficult to reach with the heating medium the apparatus may run a little harder without wasteful forcing.

BLOWING THROUGH IN HOT BLAST HEATING ADVOCATED.

The writer is rather of the opinion that a somewhat greater efficiency in heat transmission may be gained when the air is blown through the heater, being then under slight pressure, forced into contact with every portion of the surface of a section, on the farther surface as well as on the near surface and sides, rather than where it is drawn through slightly below normal pressure leaving a partial vacuum behind the heater sections where the air would not come into so close contact with the heating surface. There is this argument on the other side, viz: that the air at the lower pressure with the drawing method is at a slightly lower temperature, and therefore, has greater capacity for absorbing pressure and temperature of the plenum system. The writer is as yet uninformed as to whether any experiments have been made with this idea in view. Very often convenience of arrangement would have more weight in determining a choice between the two methods.

There is great need of additional information as to the exact influence of wide variations of temperature on the rate of radiation from surfaces at high temperatures and of the rate of transmission of heat by various building materials at great differences of temperature and of air velocities. With the increasing demand for heating, ventilating and drying plants of large size, there are many new conditions continually arising along lines in which our information is as yet very meager.

LOCATION OF REGISTERS.

It seems that the most rapid change of air will be obtained when the warm air is introduced near the floor on the unexposed side of the room and exhausted near the floor on the cold side. With this arrangement, however, the temperatures will vary greatly between the points of inlet and outlet, and the more uniform temperature will be obtained by admitting the warm air on this exposed side near the floor and discharging it on the protected side near the floor.

With this lesser difference in temperature between different parts of the room the natural movement of the air, due to the difference in specific gravity, will be somewhat less, and it will require slightly greater assistance from the fan, but as our object is not to do the easiest job, but the best one, this is the method to choose.

This reasoning is modified to some extent when using a combined direct and indirect system. In the opinion of the writer, however, the arguments in relation to positions of inlet and outlet registers and direction of flow of air for indirect heating will hold good in this case also, though with somewhat less force, because of the lesser range of temperatures and any deviation in positions of registers, suggested by greater convenience in running flues, etc., from the method advocated above, would have a less deleterious effect on the distribution of air than when the range of temperature is greater.

The question of uniformity of temperature, while of great importance, is not the only one affecting the location of registers. The point of greatest density of impurities is affected by the direction and course of the air in its movement through the room. If possible, the registers should be placed that the greatest accumulation of impurities will be beyond the breathing line; i. e.: so that the products of respiration will not come again within the breathing line after passing from the lungs.

The air on expulsion from the lungs is considerably warmer than that of the ordinary room and therefore rises at once towards the ceiling. This is pushed along ahead of the fresh, incoming air, cooling as it goes and finds its way to the outlet. If the outlet is near the ceiling, the change of air is more rapid, though less complete than if near the floor, but the requirement just mentioned of keeping the respired air out of the breathing zone will be more positively accomplished by the ceiling outlet.

On the other hand, with the outlet registers near the ceiling more heat is carried out by the warmer exhaust air, and more is necessary to be supplied than when the discharge is near the floor and, as said before, the temperature differences throughout the room are greater as the lower corner of the room below the outlet is by-passed, and that corner remains cooler to that extent.

In some cases the outlet has been placed near the floor on the same side of the room as the inlet, and nearly under it, with flues adjoining or near together, the inlet being 7 or 8 ft. above the floor, the engineers claiming that the air thus has to make the complete circuit of the room and produces a more thorough change of air. This method has the merit of economy of construction because of convenient location of flues, especially when along inside walls, but is bad for uniformity of temperature. With a falling current of air along the outer wall, there is a current of cold air past the feet of persons in the room, more so than when the current along the floor is from the inner to the outer wall.

When both inlets are on the exposed side of the room, and the outlet register is rather small in proportion to the inlet, so that the air will be forced to all parts of the room before escaping, this method will be fairly successful, but if the outlet is large in proportion to the inlet, or even in the usual proportion, there will be a tendency to short-circuit the change of air throughout the room, and the air in the farther part of the room is likely to be less frequently changed.

At first thought it would appear that on account of the great difference in specific gravity of the principal ingredients of the foul air of respiration, viz: carbon-dioxide, CO_2, and carbon monoxide, CO; the former being 1.5197 at 32° F. and the latter 0.9671, a difference of nearly 1.6%, there would be a difference in proportion of the two gases at different levels in the room, but the law of the mixture of gases is that, after a sufficient length of time has elapsed for the mixture to take place, gases of different densities will become equally diffused at different levels.

For economical heating and ventilation, without doubt the outlet register should be near the floor, and in many ordinary cases this will be sufficient. In public toilets, hospital wards, crowded assembly rooms, chemical laboratories, etc., there should also be an outlet at or near the ceiling. Under many conditions this upper outlet may be kept closed, as when the room is unoccupied at night, or in very cold weather, etc., and the foul air then be exhausted near the floor.

How to Measure Air Velocities With a Pitot Tube

A proposed method for obtaining accurate results in the measurement of air velocities, where a Pitot tube is used, has been drawn up by a special committee on the subject appointed by the American Society of Heating and Ventilating Engineers, the chairman of which is J. I. Lyle, of New York. Following are details of the committee's recommendations:

Pressure readings of 1 in. or less should be taken on an Ellison type differential draft gauge, graduated to at least hundredths of an inch, calibrated by a hook gauge. Readings over 1 in. should be taken either with an Ellison type gauge or with a U-tube graduated to at least tenths of an inch. Great care should be taken to have perfectly tight connections, especially on the static side. A slight loss of pressure here will cause a correspondingly high velocity pressure reading, and so will indicate too great a velocity.

The reading should be taken at a cross section where the pipe is straight and the flow undisturbed. This should be preferably at least 10 diameters from the fan outlet, from an elbow, or from a change in cross section in the duct. This condition is difficult of attainment in many installations and where it can not be attained the average of the maximum practicable number of readings at the point farthest away from the outlet or obstruction should be taken. The read-

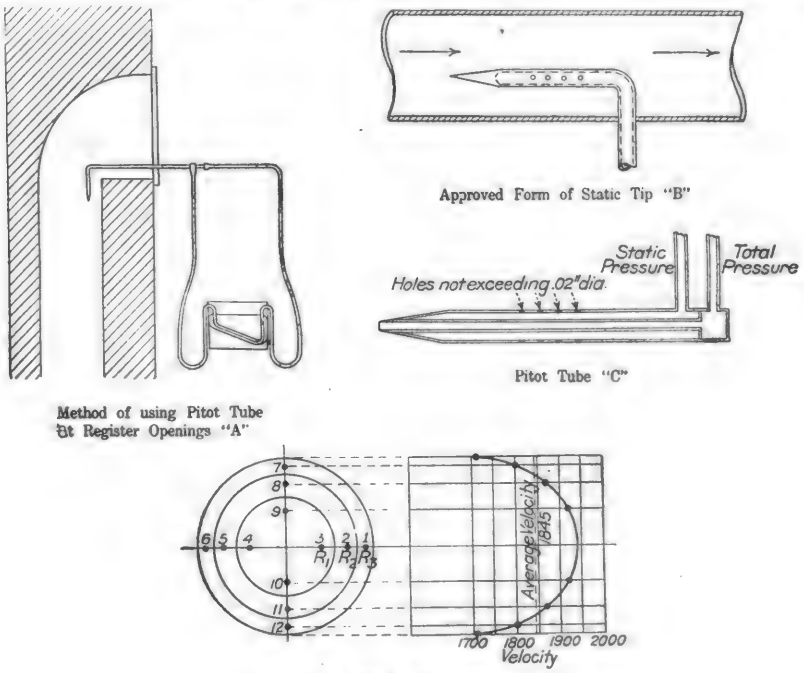
ings should be taken over a plane at right angles to, and the tube should be pointed in a direction parallel to, the direction of the air flow.

Pressure readings can not be taken over the face of an outlet with a Pitot tube the same as is done with an anemometer, but by inserting the tube in the pipe at the edge of the outlet with the tip of the tube pointed against the air flow, under the same conditions as illustrated in diagram A, a traverse of the pipe can be made at a point just before it reaches the outlet.

The most difficult reading to take accurately in a current of air is the static pressure. The approved form of static tip shown by diagram B, is the form recommended for fan testing work. There should be 8 or more clean holes 0.02 in. in diameter, an equal number on each side of a ¼-in. tube 1/32 in. thick. The most approved form of Pitot tube combines the foregoing static tip with an impact tube as shown by diagram C, by means of which total, static, or velocity pressure may be read.

In making a traverse of a rectangular duct the cross sectional area may be divided into a number of smaller rectangles and a reading taken in the center of each small rectangle.

A round pipe should be divided into at least three concentric zones of equal area per *foot in diameter,* and four readings taken on a circle drawn through the center of area of each zone or ring. That is, readings should be taken across the horizontal and vertical axis of the pipe as shown on diagram B. The location of these points from the center is shown together with the accompanying table, No. 1, which gives the distance from the center of the pipe to point of reading, expressed in per cent. of the pipe diameter. To get exact results a small pipe should be divided into more zones than a pipe of larger diameter as the ratio of frictional surface to cross sectional area is greater, hence the more static pressure in proportion to the impact pressure, which correspondingly reduces the velocity pressure.



STANDARD METHODS OF USING PITOT TUBE.

The corresponding velocities for each of these readings should be determined and an average taken of all of these velocities in order to compute the air quantity. *Inasmuch as the velocity varies as the square root of the pressure, accurate results cannot be obtained by*

TABLE I.—PIPE TRAVERSE FOR PITOT TUBE READINGS.

Distance from Centre of Pipe to Point of Reading in Percent. of Pipe Diameter.

No. of equal areas in traverse.	No. of readings.	1st R_1	2d R_2	3d R_3	4th R_4	5th R_5	6th R_6	7th R_7	8th R_8
3	12	20.4	35.3	45.5					
4	16	17.7	30.5	39.4	46.6				
4	20	15.5	27.2	35.3	41.7	47.4			
6	24	14.5	25.0	32.3	38.2	43.3	47.9		
7	28	13.4	23.1	29.9	29.9	35.3	40.1	48.2	
8	32	12.5	21.6	28.0	33.2	37.6	41.5	45.1	48.4

averaging the pressure readings and taking the corresponding velocity as the average.

The velocity may be determined from the velocity pressure by use of the formula.

$$v = 1096.5 \sqrt{\frac{P}{W}}$$

v = velocity in ft. per min.
P = pressure in in. of water.
W = weight of air in lb. per cu. ft. under the existing conditions of temperature, barometer and humidity.

With dry air at 70 deg. and 29.92 in. barometer $W = 0.0749$ whence the formula becomes

$$W = 4005 \sqrt{P}$$

With saturated air at 70 deg. and 29.92 in barometer
$W = 0.0735$ and

$$v = 4046 \sqrt{P}$$

Where approximate results only are desired.

For circular pipe, multiply the velocity pressure taken at the center of the pipe by 0.81 or the velocity by 0.91.

For rectangular pipe, no definite factor can be given which is even approximately correct that will cover the varying proportions of width to height of the cross sectional area of rectangular ducts.

Table 2 gives corresponding velocities for various velocity pressures of dry air.

Your committee recommends the Pitot tube as a simple and convenient instrument for the measurement of air or gases, which, when used with the proper care and accuracy of reading, gives results with an error of less than 1½% with velocity pressures ranging from 0.1 in. upwards.

TABLE 2. CORRESPONDING VELOCITY FOR DRY AIR AT VARIOUS PRESSURES AND TEMPERATURES.

Pressure		Temperatures Degrees F.									
In.	Oz.	50	60	70	80	100	150	200	300	500	550
0.1	0.0577	1242	1255	1266	1278	1300	1358	1413	1516	1704	1830
0.2	0.1154	1757	1776	1791	1808	1841	1921	2000	2145	2411	2590
0.25	0.1443	1965	1986	2003	2022	2059	2149	2235	2399	2696	2895
0.3	0.1730	2151	2175	2193	2214	2254	2352	2447	2626	2952	3175
0.4	0.2308	2485	2512	2533	2557	2603	2717	2827	3033	3409	3660
0.5	0.2884	2778	2808	2832	2859	2911	3038	3160	3391	3812	4095
0.6	0.3460	3043	3076	3102	3131	3188	3327	3462	3715	4175	4490
0.7	0.4037	3287	3323	3351	3383	3445	3595	3740	4013	4510	4850
0.75	0.4326	3402	3439	3468	3501	3565	3720	3870	4153	4668	5020
0.8	0.4614	3524	3552	3582	3616	3682	3843	3997	4290	4821	5185
0.9	0.5190	3728	3768	3800	3836	3906	4076	4241	4550	5114	5500
1.0	0.5768	3929	3971	4005	4043	4117	4296	4470	4796	5390	5795
1.25	0.7209	4393	4440	4478	4520	4602	4804	4997	5362	6027	6470
1.50	0.8650	4812	4864	4905	4952	5042	5262	5474	5874	6602	7100
1.75	1.0092	5197	5254	5298	5348	5446	5683	5912	6344	7131	7655
2.00	1.1535	5556	5616	5664	5718	5822	6076	6320	6783	7624	8195
2.25	1.2975	5892	5956	6007	6064	6174	6443	6704	7193	8085	8690
2.50	1.4418	6211	6278	6332	6392	6508	6792	7066	7582	8523	9150
2.75	1.5860	6514	6585	6641	6704	6827	7124	7412	7952	8938	9600
3.00	1.7300	6807	6879	6937	7003	7130	7440	7742	8307	9336	10000
4.00	2.3070	7857	7942	8010	8086	8233	8592	8940	9581	10780	11580
5.00	2.8840	8772	8867	8943	9027	9192	9593	9980	10710	12037	12900
6.00	3.4600	9623	9728	9810	9903	10083	10523	10950	11750	13203	14180

Coefficient of Heat Transmission in a Pressed Steel Radiator

TESTS SHOWING COMPARATIVE EFFICIENCY OF CAST IRON AND SHEET METAL RADIATORS.

BY JOHN R. ALLEN.

(*Presented at the annual meeting of the American Society of Heating and Ventilating Engineers, New York, January 20-22, 1914.*)

There is available very little information in regard to the heat transmission in pressed-steel radiators and this paper is presented so as to contribute some information on this type of radiation. The tests reported herein were conducted in the mechanical laboratory of the University of Michigan, by Prof. John E. Emswiler, in charge of the Experimental Laboratory. The radiators tested were 12-section, 2-column 38-in. cast-iron radiators of the Rococco type, which type was used as a standard, a 12-section, 2-column, 38-in. pressed-steel radiator, and a 12-section, 2-column, 14-in. pressed-steel radiator. The sections of the cast iron radiators were spaced 2½ in. and of the pressed steel 2 in.

The cast-iron radiator had, by actual measurement, 48 sq. ft. of superficial surface; the 38-in. pressed-steel radiator had 47 sq. ft. of superficial surface, and the 14-in. radiator had 35½ sq. ft. of superficial surface. The rated surface for the 38-in. radiators was 48 sq. ft., for the 14-in. radiator 36 sq. ft.

Two sets of tests were made, the first to determine the coefficient of heat transmission with the radiator placed under the windows and parallel to the wall, and the second with the radiator in a similar position with reference to windows but perpendicular to the wall as shown in Figs. 1 and 1*a*. Additional tests were made to see if there was any appreciable difference in the speed with which a room can be heated with the two types of radiation.

To test the relative value of the two types of radiation two rooms were selected of approximately the same size and the same amount of exposed wall and window surface. The cast-iron radiator was placed in one office and the pressed-steel radiator in the other. A plan of the offices and details of the connections are shown in the illustrations. Steam was supplied to the mains carrying 125 lbs. pressure per square inch and reduced to 5 lbs. pressure by reducing pressure valve. The steam was carried from the valve to a tee and from this point a 1-in. pipe was connected to each radiator. From the return side of the radiator the water of condensation was carried through water seals and cooled in long pipe connections before going to the weighing tanks. These water seals were provided with gauge glasses and the valves on the return lines were adjusted so that the water was kept at a uniform height in the wells, as shown in Figs. 2, 3, 4 and 5.

Considerable care was exercised in placing the thermometers in the rooms so as to give average room temperature. The location of the thermometers is shown in Figs. 1, 2 and 3, the thermome-

TABLE I.

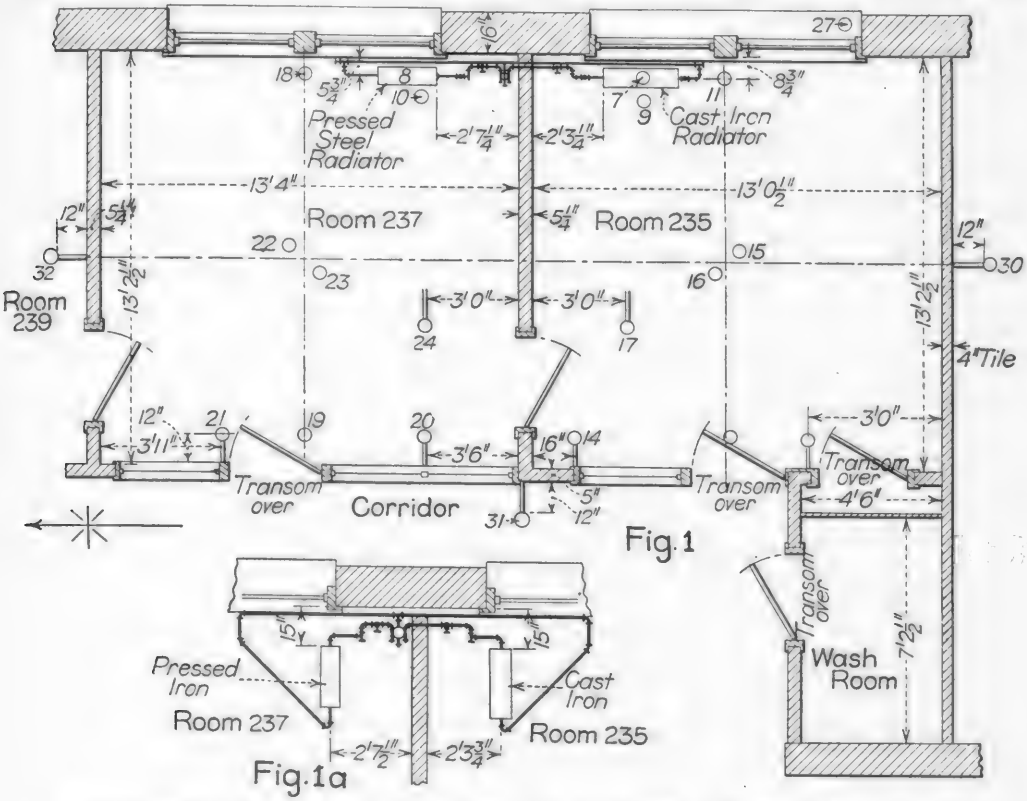
Radiators	Test No. 1. Iron Cast	Test No. 1. Steel Pressed	Test No. 2. Iron Cast	Test No. 2. Steel Pressed
Gauge pressure	5.00		4.00	
Absolute pressure	19.56		18.54	
Temperature outside air, deg. F.	31.		33.5	
Temperature entering steam, deg. F.	227.6	228.3	224.2	223.4
Temperature corresponding to pressure, deg. F.	226.8	226.8	224.	224.
Degrees superheat	0.8	1.5	0.2	0.
Average temperature of room, deg. F.	79.9	80.6	80.7	79.5
Difference steam and room temperature	146.9	146.2	143.3	144.5
Pounds of steam condensed per hour	11.29	10.92	11.53	11.22
Total B. T. U. transmitted per hour	10,850	10,510	11,100	10,800
Total B. T. U. transmitted per sq. ft. rated surface.	226	223	231	230
Total B. T. U. transmitted per sq. ft. actual surface.	226	219	231.2	225
Coefficient of transmission rated surface	1.539	1.498	1.612	1.557
Coefficient of transmission actual surface	1.539	1.527	1.612	1.592

ters being indicated by circles. In order to be sure that the conditions were practically the same in both rooms a test was made with radiators in their initial position; then these radiators were interchanged, the pressed-steel radiator being placed in the room where the cast-iron radiator had previously been and vice versa. No appreciable difference in condensation was recorded.

Table 1 gives the results obtained from these tests.

capacity of the radiator a test was made with all the furniture removed, the other conditions remaining the same; but a careful comparison of the results shows that the effect of the furniture was negligible and the results of these tests have not been given.

An examination of the table shows that the coefficient of heat transmission from a pressed-steel radiator is almost the same as that from a cast-iron radiator. The pressed-steel radiator, taking an



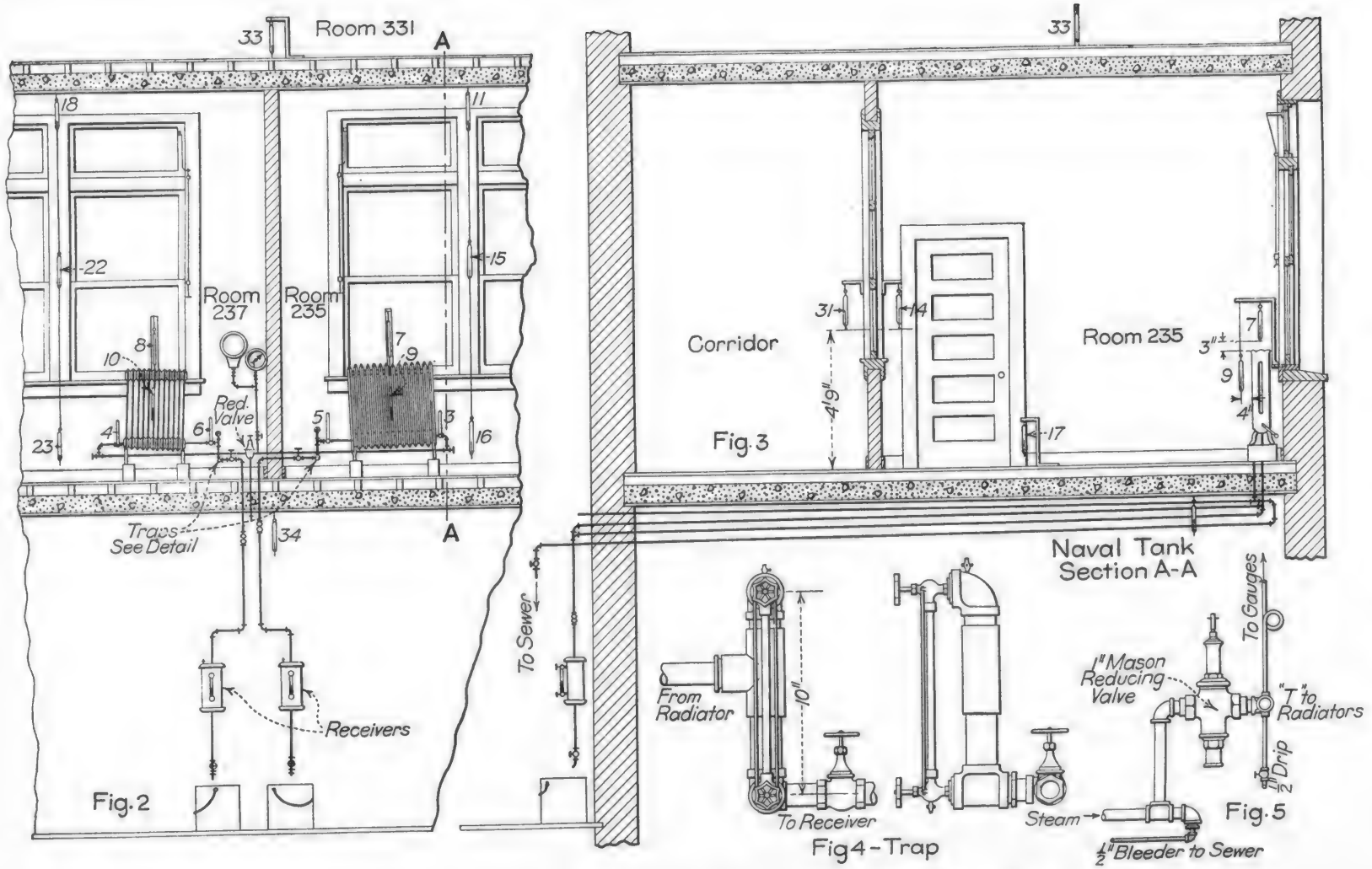
FLOOR PLAN SHOWING POSITION AND LOCATION OF RADIATORS AND THERMOMETERS DURING TESTS.

Radiators were placed as shown in Fig. 1 in tests 6, 7, 10, 11 and 12, and interchanged in tests 2, 3, 4 and 5 and in test 14 as shown in Fig. 1a.

In test No. 1 the radiators were placed parallel to and under the windows, as shown in Fig. 1, and in test No. 2 the radiators were placed near the windows at right angles to the walls, as shown in Fig. 1a. In comparing these two tests it will be noticed that the radiators give slightly better results when placed at right angles to the walls, the actual percentage increase being about 5 per cent. In order to determine whether the furniture in the room had any effect upon the average of ten tests, shows a slightly smaller result, the average difference being about 3%, that is, the pressed-steel radiator shows a heat radiation about 3% less than might be expected from a similar type of cast-iron radiator.

RELATIVE SPEED OF HEAT.

It was thought that, owing to the difference in weight of the two types of radiator used in these tests, there might be an appreciable difference in the speed with which these two types of radiation



DETAILS OF THE EQUIPMENT FOR TESTING THE RADIATORS.

would heat the rooms and the test was made in order to determine the difference. The cast-iron radiator used weighed 316½ lbs., while the steel radiator weighed 108.3 lbs. It is natural to suppose that a pressed-steel radiator be-

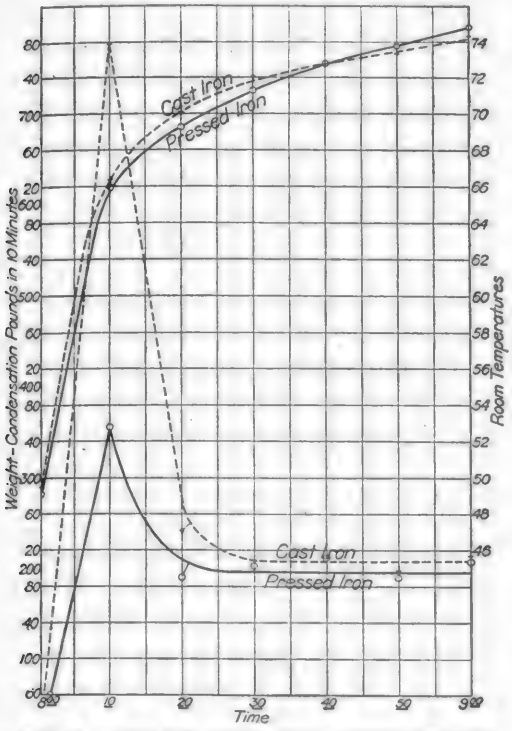


FIG. 6. CHART SHOWING RESULTS OF TESTS.

ing much lighter would warm the room more rapidly than the heavier cast-iron radiator.

Fig. 6 shows the increase in temperature in two similar rooms, the increase being plotted on the right hand side, the abscissae being temperature and the ordinates being time. On the left hand side the ordinates are weighings of condensation in pounds taken at 10-minute intervals. The upper curve shows the increase in temperature in the room. The lower curves shows the condensation. The dotted line is for the cast-iron radiation and the solid line for the pressed steel. It will be noticed that the heating effect as shown by the rise in temperature of the rooms is practically the same in both rooms and apparently these tests show that the difference in weight of the two types of radiation made very little difference in the actual rise in temperature of the rooms. The condensation curve, however, shows that the cast-iron radiator had a much more rapid condensation for the first 10 minutes, about 3½ times the normal, but at the end of 20 minutes this condensation had almost reached the normal; by 30 minutes normal condition had been reached. In the pressed-steel radiator condensation for the first 10 minutes was about twice the normal, and at the expiration of 20 minutes the radiator had reached normal conditions of condensation.

COMPARISON OF HIGH AND LOW RADIATORS.

A set of tests was also made to determine the heat transmission of two radiators of the pressed-steel type of different heights. The results show that with a temperature difference between the room and steam of 143° F. the coefficient of transmission for the 14-in. radiator was 1.647 for the rated surface and 1.855 for the actual surface of the radiator; for the 38-in. radiator, under similar conditions, the coefficient was 1.498 for the rated surface and 1.527 for the actual surface of the radiator. These are approximately the same results as would be expected from cast-iron radiation.

Cooling Two Rooms in a Country Residence

BY A. M. FELDMAN.

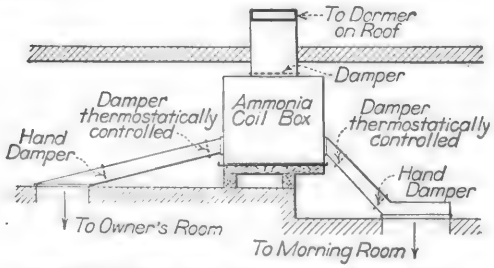
(*Presented at the Annual Meeting of the American Society of Heating and Ventilating Engineers, New York, January* 20-22, 1914.)

For the country residence of Mr. Paul M. Warburg at Hartsdale, N. Y., the author was called upon to provide a design for cooling the owner's bedroom and morning room, in conjunction with the installation of a small refrigerating plant to be used for pantry and kitchen refrigerators. The rooms are 28 ft. x 23 ft. x 11 ft. and 21 ft. 6 in. x 19 ft. x 10 ft. respectively. This problem was solved

by installing a cork insulated box with 300 ft. of 1 in. galvanized iron pipe in the attic immediately above the rooms. The top of the box was connected with a short duct to the roof dormer for taking in fresh air, and from the ends near the bottom two galvanized iron ducts were connected to the ceiling registers of the two rooms as shown on the accompanying plan. Fresh air enters the top of the box, is cooled and drops by gravity through the registers to the floor of the rooms. The cooled air there moves forward and escapes through the partially opened windows, thus creating the necessary change of air for ventilation.

The author took advantage of the thermostats which were installed in the rooms in connection with the heating system and connected them with driaphragm levers to control dampers in the ducts, thus providing means for automatically shutting off the cold air in case the rooms would become colder than desired.

Tests showed a temperature in the rooms of about 6° F. lower than out of doors.

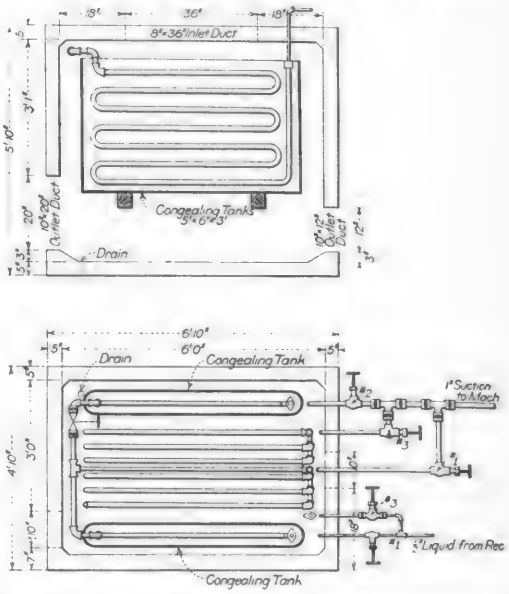


ELEVATION OF COOLING BOX AND CONNECTIONS IN ATTIC.

The cooling box is provided with two narrow but deep so-called congealing tanks filled with brine with part of the coils submerged therein. The chilled brine in these tanks furnishes enough cold storage to cool the air part of the night when the refrigerating machine is not in operation. The ammonia piping is arranged in three coils with valves as shown in the accompanying drawing. The coils are cooled by direct expansion of ammonia.

The structural details of the box are also indicated in an accompany illustration, which shows the position of the congealing coils and the location of the valves. These valves give flexibility to the system in operation, as the ammonia may be expanded in one or both congealing tanks or in the third coil independently.

To prevent possible leaks, all the ammonia pipes throughout the installation are welded together by means of the Goldschmidt thermit process.



DETAIL OF AIR-COOLING REFRIGERATOR AND CONNECTIONS.

All the ammonia pipes and ducts are properly insulated with cork covering. The ammonia compressor is a 5-ton, two-cylinder vertical machine driven by an electric motor through a short belt, with a belt tightener idler.

In order not to waste it, the condensing water is pumped back to the general domestic elevated supply tank by means of a small motor-driven centrifugal pump. The water was never found to have any odor or taste of ammonia.

NATIONAL DISTRICT HEATING ASSOCIATION

Campaign for New Members.

A campaign to increase the membership of the National District Heating Association has been inaugurated by the officers of the association. Members are requested to correspond with one or more of a list of prospective members sent out by the association with a view of securing their applications for associate membership.

Heating and Ventilation Laws and Regulations in the United States

REQUIREMENTS OF RECENTLY-ENACTED AND OTHER LAWS NOW ON THE STATUTE BOOKS IN THE VARIOUS STATES.

The enactment of new heating and ventilation laws in such States as Massachusetts, Ohio and Indiana and the changes made in the requirements in some of the other States makes a review of the subject timely as well as necessary.

No attempt will be made here to list the laws in the order of their passage or alphabetically by States. Such an arrangement, however, will be followed in a reprint which we shall make later, to be published as the third edition of "Ventilation Laws." In the following summary those laws which have been passed most recently are given first place.

Indiana.

New rules and regulations governing the construction, equipment and maintenance of sanitary features of public and parochial school buildings were passed by the Indiana State Board of Health, December 17, 1913. These rules and regulations have all the force of law, the State Board being empowered, among other things, to "regulate and prescribe the character and location of plumbing, drainage, water supply, lighting, heating and ventilation, and all sanitary features of all public buildings and institutions, * * * and any violation of said rules shall be punished by a fine of not less than five nor more than fifty dollars for each offense." (Chapter 144, Acts 1909, Part of Section 6.)

The rules take up the site for school buildings, followed by construction features. In connection with the size of class rooms, it is provided that no class room shall exceed 24 ft. in width. The ceiling shall be not less than 12 ft. nor more than 14 ft. in height. Wood ceilings shall not be used.

The provisions covering heating and ventilation are extensive and include both the requirements and the methods of fulfilling such requirements. They are as follows:

Heating and Ventilation: Heating and ventilating systems of all kinds shall take fresh air from outside the school building, evenly diffuse the same throughout each schoolroom during school session and withdraw foul air from said schoolroom at a minimum rate of 1,800 cu. ft. per hour for each 225 cu. ft. of said schoolroom space, regardless of outside atmospheric conditions.

a. Test—The State Board of Health will test the efficiency of ventilating systems in school buildings as follows: With jacketed heaters and gravity systems, the anemometer test shall be made over the foul air vents in classrooms. With plenum systems, the anemometer test shall be made over the fresh air inlet of the fresh air room and the fresh air inlet in classrooms. With a double system of mechanican ventilation, the anemometer test shall be made at the fresh air intake and at the foul air vents in classrooms. In every test five readings shall be taken, one near each corner and one at the center of the air-opening to be tested. A deduction of 5% shall be made for a grill or register in the air opening. All tests shall be based upon the seating capacity of classrooms at 225 cu. ft. of space per pupil. Before such test shall be made by the State Board of Health, the heating and ventilating contractor shall be given notice of the time when such test is to be made. The State Board of Health will make such tests upon the written request of trustees, school boards, boards of school commissioners, county, city or state superintendents, or upon petition of ten or more patrons of the school.

Plenum and Gravity Systems of Ventilation: Where plenum systems of ventilation are used, the warm air flues shall have a cross-sectional area of not less than 10 sq. in. for each occupant of the room, based on the seating capacity of the room. The vent flues shall have a cross-sectional area of not less than 10 sq. in. for each occupant of the room, based on the seating capacity of the room.

Where gravity systems of ventilation are used, the warm air flues and vent flues shall each have a cross-sectional area of not less than 16 sq. in. for each occupant of the room, based on the seating capacity of the room.

a. Location of Flues—In school buildings of more than one room with plenum or gravity ventilation the warm air flues and vent flues shall be on or in the inside walls of the building, and the warm air inlets and the foul air vents shall be on the same side of the room. Warm air inlets shall be located not less than 5 ft. from the floor. Wire screens of No. 8 gauge wire with 1½-in. mesh may be used to cover the warm air inlets, except in rooms of such size and shape as to require the air to be deflected, in which case diffusers may be used. Four air vents shall be at the floor level, shall have a free area of not less than the cross-sectional area of the flue, and shall be clear of all obstructions. Grills or registers shall not be used in foul air

vents except with jacketed heaters. A chain damper, or other approved device, in plain view and easily accessible from inside the room shall be used to close the vent when not in use. The damper shall be kept open at all times when school is in session. The floor and baseboard shall be carried into the bottom of vent flue, and that part of the flue exposed to view shall be plastered and finished the same as the walls of the room.

Reheated Air: No vitiated air shall be reheated except as provided under jacketed heaters and floor furnaces, or except where an air washing system has been installed, and such system of rewashing and reheating air has been approved by the State Board of Health.

Foot Warmers: So-called foot warmers, if used, shall be placed in the walls of the main corridors at the floor level. No warm air register or pedestal register shall be placed in the floor in any school building.

Air Supply:

a. In gravity or plenum systems of ventilation, except where wall openings directly into schoolrooms are used, the air supply shall be taken from outside the building through a window or windows into a room in the basement especially constructed for this purpose, with tight fitting door, impervious and smooth walls, floor and ceiling, to be known as the fresh air room. The window or windows in the outer wall of the fresh air room shall have a free area not less than the combined cross-sectional area of all the warm air supply ducts, and shall be covered with a substantial wire screen of not more than ½ in. mesh and shall be kept free from obstruction. This fresh air room shall be kept clean and free from obstruction at all times. In no case shall basement air be permitted to enter the air supply.

b. In gravity systems where wall openings directly into the rooms are used, the fresh air supply shall be from outside the building, and the combined free cross-sectional area of fresh air intakes shall be not less than the cross-sectional area of foul air flue. Such fresh air intakes shall be free from obstruction, and shall be provided with an approved damper with operating device in plain view and easily accessible from inside the room. The damper shall be kept open at all times when school is in session. The outside openings of such fresh air intakes shall be covered with substantial wire screen of not more than ½-in. mesh, and shall be provided with a suitable hood or elbow to protect from rain or snow.

c. With jacketed heaters the fresh air supply shall be from outside the building, and the fresh air duct shall be provided with an approved damper with operating device in plain view, and easily accessible from inside the room.

d. No fresh air opening or foul air vent in connection with any system of ventilation shall be closed at any time when school is in session.

e. No part of the machinery, shafting, or pulley arrangements, of heating and ventilating apparatus, or water works system, shall be connected to the joist or flooring above.

f. All flues shall start upon substantial foundation at the ground, shall extend through the attic and above the highest point of the roof, and, when necessary, shall be equipped with proper cowls to prevent down draft. Flues shall be built the same size the entire height, and all inside walls shall be plumb, true and finished to a smooth finish. The outside walls of all chimneys shall be not less than 8 inches thick.

Cloakrooms and Wardrobes: Where cloakrooms or wardrobes are not separated from classrooms, or are separated only by skeleton doors, they shall be considered as part of the classroom, and the foul air vent shall be placed in the cloakroom or wardrobes. Where cloakrooms or wardrobes are separated from classrooms, they shall be separately heated and ventilated the same as classrooms. Where suitable cloakrooms cannot be provided, sanitary steel lockers may be placed in the corridors or classrooms, provided that such lockers will not in any way become an obstruction to the free passageway of the corridor.

Ventilation in Laboratory and Domestic Science Rooms: Gas plates, gas stoves and burners used in domestic science or laboratory work shall be provided with suitable ventilating hoods connected with a vertical vent flue. This flue shall be separate from any other vent flue and the updrift in such flue shall be positive at all times.

Temperature Regulation: Whenever practical, temperature regulation shall be used.

Whatever system of ventilation is used, the windows in all schoolrooms shall be opened whenever practical at recess periods and before the opening of the afternoon school session in order to thoroughly change the air of the rooms.

Basement Air: In every stairway leading from the first floor to the basement, there shall be a swinging door with spring hinges to prevent basement air from entering the classrooms and corridors above, except where basement rooms are finished, have close fitting doors and are properly warmed and ventilated.

* * *

Under "Toilets," the provisions are that "there shall be ventilating opening back of each individual water-closet bowl and each seat of the latrine of not less than 10 sq. in. free area, and each urinal stall shall have a venti-

lating opening both top and bottom of not less than 8 sq. in. free area. These toilet ventilating openings shall be connected to a vertical brick vent flue extending above the highest point of the roof. The updraft in this flue shall be positive at all times and shall be maintained either by aspiration or by use of an exhaust fan. If aspiration is used, the cross-sectional area of this toilet vent flue shall be not less than 360 sq. in. If an exhaust fan is used, the cross-sectional area of this toilet vent flue shall be equal to the combined area of the toilet ventilating openings connected with such flue.

"Whenever proper ventilation of the toilet room is not provided by means of the closet system installed, the toilet room shall be properly ventilated by means of a separate vent flue."

Under "Humidity," the regulations are that "whenever practicable a system of air washing shall be installed in connection with plenum and gravity systems of ventilation in order that the air may be properly humidified before being introduced into the schoolroom. Where the air supply is direct to the schoolroom, through wall openings, each radiator shall be provided with a pan or receptacle to hold not less than one gallon, and so placed as to be constantly warmed and in plain view. Water shall be kept in such receptacle at all times when school is in session and the heating system is in use.

Jacketed heaters and floor furnaces shall be provided with a pan or receptacle to hold not less than three gallons, and so placed as to be constantly warmed and in plain view. Water shall be kept in such receptacles at all times when school is in session and the heater is in use.

Cleaning and Sweeping: Whenever practicable, vacuum cleaning equipment shall be installed in school buildings. Dry sweeping and dusting is prohibited, and no sweeping shall be permitted in corridors, schoolrooms or stairways while school is in session. Floor oil, some form of dust-down or sawdust treated with oil should be used on floors before sweeping.

Directions for Management: Whenever a system of heating and ventilation is installed, the heating contractor shall furnish full and complete printed instructions for the proper management and care of such system to the superintendent, principal or teacher of the school, and shall in addition post a copy of such instructions in a prominent place in the boiler or furnace room for the instruction of the janitor.

Heating: The heating apparatus and appliances not otherwise provided for in these Rules must conform to the Rules and Regulations of the State Fire Marshal.

Architects shall furnish heating and ventilating contractors full and detailed plans of all parts of the building in any way connected with the installation of heating and ventilating apparatus. Architects, sanitary engineers and heating and ventilating engineers shall certify by affidavit endorsed on all plans and specifications submitted, that such plans and specifications comply with the Indiana Sanitary School House Law, and with the rules of the Indiana State Board of Health.

The regulations here given are based in part on "The Sanitary Schoolhouse Law" (H. 494. Approved March 14, 1913). This law states under "Heating and Ventilation:"

Heating and Ventilation: All schoolhouses hereafter constructed or remodeled, shall be supplied with heating and ventilating systems. Fresh air shall be taken from outside the building and properly diffused without draughts, through each schoolroom during the school session. Each schoolroom shall be supplied with foul air flues of ample size to withdraw the foul air therefrom at a minimum rate of 1,800 cu. ft. per hour for each 225 cu. ft. of said schoolroom space, regardless of outside atmospheric conditions; and heaters of all kinds shall be capable of maintaining a temperature of 70° F. in all shoolrooms, halls, office rooms, laboratories and manual training rooms, in all kinds of weather, and maintaining in each schoolroom a relative humidity of not less than forty per cent: *Provided,* That when artificial ventilation, by use of fan or blower, is adopted, the provision as to entrance of fresh air shall be from outside of the building.

It is hereby made lawful for any township trustee, board of school trustees and boards of school commissioners to establish and maintain open air schools, and when such open air schools are established the provisions of this act governing heating and ventilation shall not apply to such open air school rooms.

Massachusetts.

The following regulations are among those referred to in the recent report of the Massachusetts Chapter of The American Society of Heating and Ventilating Engineers in which the chapter stated that it does not endorse the interpretation of this law as made by the Massachusetts District Police Inspection Department, as to the ventilation of theatres, halls and places of public gathering, because the law states that "the ventilation in all cases shall be taken off from near the floor level."

These regulations are published as Form F and cover "the erection, alteration and inspection of miscellaneous halls." A mis-

cellaneous hall is defined as a building or part of a building used as a hall for entertainment, a place of assemblage or a place of public resort, and having a capacity for seating not more than 400 persons, also a hall for society use or a school hall, to each of which a certificate has been issued by an inspector.

Definitions are also given for halls of entertainment, halls for places of assemblage, halls for places of public resort and halls for society use.

Under "Heating and Ventilation" the regulations state:

"The audience hall shall have such means as to insure the removal near the floor levels, through ventiducts with approved regulating dampers, of at least 2½ cu. ft. of air per minute for each foot in area of the audience hall and gallery floors, and to supply pure air equal in amount at such height from the floor as to insure proper circulation, with means for the proper heating of such air when necessary, with approval methods for regulating the temperature, and sufficient means for heating as to maintain a temperature throughout the audience hall of 70 degrees F. in zero weather. The velocity of the air entering the ventiducts shall not exceed 500 feet, and of the air entering the audience hall shall not exceed 350 feet, per minute. Provisions may be made for reversing the above circulation for use when heat is not required. The stage, corridors and other parts of the building shall be properly heated when necessary."

Practically the same phraseology is used in Form D, relating specifically to "special and public halls," and in Form D, relating specifically to "theatres."

In this connection it should be noted that building plans throughout the Commonwealth are now passed upon by a supervisor of plans, and he will not approve any that do not provide for ventilation from near the floor level.

A new law has recently been passed in Massachusetts (Acts of 1913, Chapter 655), which is entitled "An Act to Revise and Codify the Building Inspection Laws of the Commonwealth." This law, which went into effect Nov. 1, 1913, is enforced by the Building Inspection Department of the District Police and contains the provisions now in effect regarding the heating and ventilating of school and other buildings. The sections relating to these subjects are given herewith:

SECTION 15. No building which is designed to be used, in whole or in part, and no building in which alteration shall be made for the purpose of using it, or continuing its use, in whole or in part, as a public building, public or private institution, schoolhouse, church, theatre, special hall, public hall, miscellaneous hall, place of assemblage or place of public resort, or as a factory, workshop or mercantile or other establishment and to have accommodations for ten or more employees, and no building more that two stories in height designed to be used above the second story, in whole or in part, and no building more than two stories in height in which alteration shall be made for the purpose of using it, or continuing its use, in whole or in part, as an office building, dormitory, hotel, family hotel, apartment house, boarding house, lodging house or tenement house, and to have eight or more rooms above said story, shall be erected, and no alteration shall be made therein, until a copy of the plans and specifications thereof has been deposited with the supervisor of plans of the building inspection department of the district police by the person causing its erection or alteration or by the architect thereof. Such plans and specifications shall include those for heating, ventilation and sanitation, as the supervisor of the plans may require.

* * *

SECTION 16. Whoever erects, constructs or makes alteration in a building, or an architect or other person who draws plans or specifications or superintends the erection, construction or alteration of a building, in violation of the provisions of this act, shall be punished by a fine of not less than fifty nor more than one thousand dollars.

SECTION 22. No wooden flue or air duct for heating or ventilating purposes shall be placed, or shall remain placed, in any building which is subject to the provisions of sections fifteen and twenty of this act, and no pipe for conveying hot air or steam in such building shall be placed, or shall remain placed, within one inch of any wooden work, unless protected to the satisfaction of the inspector by suitable guards or casings of incombustible material.

SECTION 24. (Theatres). * * *. There shall be one or more ventilators near the center and above the highest part of the stage, equal in area to one tenth of that of the stage floor back of the fire-resisting curtain, and arranged so as to open automatically from heat, and by a cord or cords from the stage floor, as the inspector shall direct.

SECTION 29. Cities may by ordinance provide that the provisions of sections fifteen, sixteen, twenty to twenty-eight, inclusive, forty-five and forty-six of this act shall apply to any building of three or more stories in height within their respective limits.

SECTION 30. In this act, the term "theatre" shall mean a building or part of a building in which it is designed to make a business of the

presentation of dramatic, operatic or other performances or shows for the entertainment of spectators, which is capable of seating more than four hundred persons, and which has a stage for such performances that can be used for scenery and other stage appliances. The term "special hall" shall mean a building or part of a building containing an audience or assembly hall capable of seating more than four hundred persons, which may be used for the occasional presentation of dramatic, operatic or other performances for the entertainment of spectators, with the use of scenery, under such conditions as the licensing officer shall direct, and for public gatherings. The term "public hall" shall mean any building, or part of a building, excluding theatres, armories, churches and schools, containing an audience or assembly hall capable of seating more than four hundred persons, and used for public gatherings, and for such entertainments, not requiring the use of scenery and other stage appliances, as the licensing officer may approve.

SECTION 40. Every public building and every schoolhouse shall be kept clean and free from effluvia arising from any drain, privy or nuisance, shall be provided with a sufficient number of proper water-closets, or privies, and shall be ventilated in such a manner that the air shall not become so impure as to be injurious to health. If it appears to an inspector that further or different heating, ventilating or sanitary provisions are required in any public building or schoolhouse, in order to conform to the requirements of this section, and that such requirement can be provided without unreasonable expense, he may issue a written order to the proper person or authority, directing such heating, ventilating or sanitary provisions to be provided. A school committee, public officer, or person who has charge of, owns, or leases any such public building or schoolhouse, who neglects for four weeks to comply with the order of such inspector shall be punished by a fine of not more than one hundred dollars. * * *

SECTION 41. In the preceding section, "public building" shall mean any building or part thereof used as a public or private institution, church, theatre, special hall, public hall, miscellaneous hall, place of assemblage or place of public resort, and "schoolhouse" shall mean any building or part thereof in which public or private instruction is given to more than ten pupils at one time.

SECTION 52. Sections fifteen, sixteen, twenty to twenty-nine, inclusive, forty-three, forty-four, forty-seven, forty-eight, fifty and fifty-seven of this act shall not apply to the city of Boston.

SECTION 54. The provisions of this act shall be enforced by the chief of the district police, and the chief of the district police shall issue such regulations as may be deemed necessary for the uniform enforcement thereof.

Acting under the authority of this act the district police have caused the following order to be issued, which succeeds "Form No. 83," which was for many years the guiding rule for the heating and ventilation of school buildings:

REQUIREMENTS OF FORM NO. 83A, INSPECTION DEPARTMENT, MASSACHUSETTS DISTRICT POLICE.

In the ventilation of school buildings the many hundred examinations made by the inspectors of this department have shown that the following requirements can be easily complied with:

1. That the apparatus will, with proper management, heat all rooms, including the corridors, to 70° F. in any weather.

2. That, with the rooms at 70° and a difference of not less than 40° between the temperature of the outside air and that of the air entering the room at warm air inlet, the apparatus will supply at least 30 cu. ft. of air per minute for each scholar accommodated in the room.

3. That such supply of air will so circulate in the rooms that no uncomfortable draught will be felt, and that the difference in temperature between any two points on the breathing plane in the occupied portion of the room will not exceed 3°.

4. That vitiated air in amount equal to the supply from the inlets will be removed through the vent ducts.

5. That the sanitary appliances will be so ventilated that no odors therefrom will be perceived in any portion of the building.

To secure the approval of this department of plans showing methods or systems of heating and ventilation, the above requirements must be guaranteed in the specifications accompanying the plans.

Further additions to these requirements are being compiled by the Inspection Department of the District Police, and will be published within the next few months.

American Society of Mechanical Engineers.

The appointment of sub-committees of The American Society of Mechanical Engineers to cover each industry and branch of engineering, is the result of a policy recently adopted by that society in order to meet the industrial expansion which has increased greatly the field of the mechanical engineer. Thirty-eight such committees are contemplated and of these twelve have already been appointed. Among those already appointed are committees on textiles, cement, machine shop, gas power and plant equipment, air machinery, industrial buldings and fire prevention. Those still to be made will take up such subjects as heating and ventilation, steam power and plant equipment, pumping machinery, electrical machinery, refrigeration and ice making, and relations with architects

The society reports a total membership for January 15, 1914, of 5,405, a net increase of 138 since December 15, 1913.

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IT IS well recognized that the enactment of salutary laws does not in itself mean the abatement of the abuses they are designed to counteract. Their enforcement very often becomes a matter of equal importance. This has been recognized in the case of the separate contract law recently enacted in Pennsylvania and we now hear of the appointment of a joint conference committee composed of delegates from the various business associations interested, whose duties will be to support the legal status and secure the enforcement of the various provisions of the act referred to, which, it will be recalled, relates to separate bids for plumbing, heating, ventilating and electrical work on public buildings in Pennsylvania.

Suits in equity have already been instituted under the new act. In Philadelphia, for instance, a special injunction was applied for and granted by the court, restraining the City's School District from opening bids and awarding contracts for the erection of a school building, the proposals for which failed to provide for separate bids. The injunction was made permanent in this case through notice by counsel that the Philadelphia School District had decided not to contest the constitutionality of the law. This is undoubtedly a representative case and should go far in clarifying the atmosphere regarding the potential effectiveness of the measure. At the same time, it will require constant watchfulness to insure the permanent observance of the law.

SOME such method may be required to take care of the engineers' interests in the enforcement of the rather extended compulsory ventilation laws that are now being written on the statute books. In Indiana, for instance, the new law on this subject, which is presented substantially in full on another page of this issue, contains such detailed provisions that the officials charged with its enforcement will no doubt have their hands full. However, if any supplementary supervision is required in this direction it will perhaps come more properly through committees representing technical societies than through business organizations. This, by the way, is the act that provoked so extended a discussion at the recent meeting of the heating engineers' society as to the desirable features to be incorporated in a model law.

WE ARE beginning in this issue the publication of the recently enacted compulsory ventilation laws and regulations now in force in the United States. These include the Indiana, Ohio and Massachusetts acts, as well as requirements adopted elsewhere. Following their publication in these columns, they will be incorporated in a new edition of "Ventilation Laws," which we first published in 1906.

THE CONSULTING ENGINEER

"The Consulting Engineer" is prepared to reply, in this department, to any questions which our readers may ask regarding problems connected with the design and installation of mechanical equipments of buildings.

26—Heating a Room with a Mezzanine Floor.

QUESTION: We have a mezzanine floor located in the center of our store. It has a floor space of about 1,200 sq. ft., and the actual dimensions are 16x20 ft. The height of the ceiling is 7 ft. It is 30 ft. from the windows in the front and about 25 or 30 ft. from the windows in the rear. The space below is used as a sound-proof demonstrating graphaphone room. At the present time we use this space only for storage and supplies, but, being overcrowded, we are considering the idea of moving our office up there, but we have not yet determined the best plan for ventilating it. Several ideas have been recommended, such as using a large exhaust fan connected to a pipe at the rear of the building. The mezzanine is open at the front, but is sealed up at the back except for a passageway running out to an elevator shaft. We should appreciate any suggestions you could offer which would make this space suitable for an office staff of seven or eight persons.

We might say that the system of heating the building, which is three stories high, is direct steam. There are four buildings of the same height on each side. The width of the building is 42 ft., our store occupying one-half of it, or 21 ft. The depth of the building is 120 ft. There is no convenient place to locate a fresh air intake. There is a light shaft on the other side of the building, but, in order to reach it, it would be necessary to pass through the adjoining store. We have tried the use of an exhaust fan installed at the back of the mezzanine floor, and it was a success so far as the moving of the air is concerned, but in order to keep fresh, cool air on the mezzanine floor it made it cold downstairs at the front of the store, as the air comes in cold from the fanlight over the door at the front.

ANSWER: As you state in your letter, you have partially solved the problem by installing the fan. The only suggestion we can make is as follows, in view of the somewhat meagre details: In front of the fanlight over the front door place a stack of indirect radiators. These might be placed overhead in the store. In case they should prove too unsightly and you have a basement, a special opening might be provided from the outside to the basement and a hole cut through to the first floor. The indirect stack could then be placed on the basement ceiling and a flow register in the opening through the first floor. This would heat all the displaced air of the store before its entrance and prevent it from becoming cold.

For the low temperatures in your climate (Canada) there should be the equivalent of probably five stacks of Vento radiators, or twenty rows of 1-in. pipe, if blower coils are used, with a velocity of not exceeding 600 ft. per minute through the stack. Care should be taken not to place the radiators or loops too far apart on centers in the stack. The extra load of this stack should be provided for in boiler power when attached to the present system.

It is assumed in the above that a minimum of 5 lbs. of steam is carried on the system, with a small drop in pressure. It might be well to measure the quantity of air passing in through the fanlight when the exhaust fan is in operation. This can be done with an anemometer. It is possible that considerably less air will be required to be heated by the indirect stack than is removed by the exhaust fan. This, however, can only be determined by experiment. The solution here given can only be an indication of how the difficulty can be remedied, due to the lack of information as to all the conditions. It will, however, prevent the store from becoming cold due to displacement of the air by the fan.

27—An Example in Air Humidifying.

QUESTION: I desire to humidify the air entering a laboratory through an existing register by adding 2 grains of moisture per cubic foot. The air supply is 24,000 cu. ft. per hour at 70° F. I wish to use a square box containing water with an automatic supply to make up the loss due to evaporation. In the box will be placed a steam coil, supplied with steam at 5 lbs. gauge.

How large should the box be and how much surface should there be in the coil with the water supply at 65° F.?

ANSWER: Inasmuch as the air is 70° F., there will be no appreciable evaporation from the water surface unless the water is boiled at 212° F., forming steam at atmosphere. The size of the box has little or nothing to do with the operation except that it must be sufficiently large to hold the immersed steam coil. A better plan would be to steam jacket the bottom of the box and possibly the sides in the same manner as a kettle used for steam cooking in kitchens. Care must be used in building it to stay it and make it sufficiently strong to withstand the maximum pressure required.

The total heat in the water at 65° F. above 32° F. is 33 B.T.U. The total heat in the steam at 212° F. is 1,150 B.T.U. Each grain of moisture evaporated will require 1,150 — 33 = 1,117 B.T.U. and

$$\frac{24{,}000 \times 2 \times 1{,}117}{70{,}000 \text{ grains}} = 7{,}670 \text{ B.T.U. per hour.}$$

Prime heating surface immersed in water as indicated will give up about 200 B.T.U. per degree difference per hour. Steam at 5 lbs. gauge is about 227° F, and, with water at 212° F., 227 — 212 = 15°; 7,670 ÷ 3,000 = 25.5 sq. ft. of heating surface.

The grains of moisture and relative humidity will be regulated by the flow of steam in the coil. The size of the box and extent of the water surface will determine the amount of ebulition from the box. If the surface is ample, the water will not boil so rapidly or noisily to supply the requisite amount of vapor. In other words, comparatively shallow pan will give the quietest operation.

As good results can be obtained by injecting the steam directly into the air, if it were not for the smell accompanying most vapor from power boilers and exhaust steam from engines. The pan of clean water will eliminate the odor.

Building Operations in January.

Building permits totaling $37,152,920 in value for 56 cities, were issued in January, 1914, according to The American Contractor, as compared with a total of $40,361,494 for the corresponding month of 1913. New York City reported a decrease of 12 per cent., Chicago a decrease of 22 per cent., Philadelphia, a decrease of 14 per cent., St. Louis an increase of 38 per cent., Pittsburgh, an increase of 204 per cent.

ELBERT HUBBARD ON TRADE PAPERS.

Advertising—Its Relation to Trade Papers.

(This series of articles commenced in the September, 1913, issue.)

He who imagines that modern advertising is the exploitation of the public is a biouspidati diplidocus, and would do well to come out of his comatose state and curry comb his convolutions.

Advertising is information as to who you are, where you are, and what you have to offer in the way of skill, talent or commodity.

To stand still is to retreat.

To worship the good Terminus is to have the Goths and Vandals that skirt the borders of every successful venture, pick up your Herminii and carry them inland, long miles, between the setting of the sun and his rising.

To hold the old customers you must get out after the new

When a fellow thinks he is big enough, there is lime in the bones of the boss, and a noise like a buccaneer is heard in the offing.

The reputation that endures, or the institution that lasts, is the one that is properly advertised.

The only names in Greek History that we know are those which Herodotus and Thucydides graved with deathless styli.

The men of Rome who live and tread the boardwalk are those Plutarch took up and writ their names large on human hearts.

All that Plutarch knew of Greek heroes was what he read in Herodotus.

Life, now, is human service.

To deceive is to beckon for the Commissioner in Bankruptcy.

Nothing goes but truth.

We know this—because for over two thousand years we have been trying everything else.

Academic education is the act of memorizing things read in books, and things told by college professors who got their education pretty much in the same way.

It is easier to be taught than to attain.

It is easier to accept than to investigate.

It is easier to follow than to lead—usually. Yet we are all heir to peculiar, unique and individual talents, and a few men are not content to follow.

"Truth," says Dr. Charles W. Elliot, "is the new virtue,"

"Let the truth be known about your business" idea has inspired the best firms to tell of their products to Trade Paper subscribers.

The only man who should not advertise is the one who has nothing to offer in the way of service, or one who cannot make good.

All such should seek the friendly shelter of oblivion where dwell those who, shrouded in Stygian shades, foregather gloom and are out of the game.

Not to advertise is to be nominated for membership in the Down-and-Out-Club.

The Adscript and the Adcrafts are opposition societies to the Mummy Trust.

About the best we can say of the days that are gone, is that they are gone.

The Adscripts and the Adscrafts look to the East. They worship the rising sun. The oleo of authority does not much interest them. They want the Kosmic Kerosene that supplies Caloric.

A good Advertiser is never either a philophraster or a theologaster—he is a pragmatist. He seeks the good for himself, for his customers, and for the whole human race.

The science of advertising is the science of psychology.

And psychology is the science of the human heart.

Advertising interest, inspires, educates, sometimes amuses—informs, and thereby uplifts and benefits, lubricating existence and helping the old world on its way to Celestial City of Fine Minds.

And especially does the Trade Paper know the Science of Advertising.

First, the Trade Paper carries no shady or uncertain advertising. Everything that treads the border line of bunco is eliminated.

The subscriber to a trade paper is, or should be, as much interested in the ads as in the text. Both inform, uplift and inspire.

The Trade Paper is in partnership with its subscribers—the interests of each are identical. The Trade Paper exists for this one reason—to render a tangible aid to the subscriber.

To amuse him, tell him of the embezzlement in Alaska, the elopement in Florida, or the seduction in California—these things are not enough. The subscriber must get ideas that he can use in his business—and any subscriber who studies the advertisements of his Trade Paper, does.

(*Copyright*, 1914, *Kovnat.*)

Efficiency Exposition and Conference.

The first national efficiency exposition and conference will be held in New York, April 4-11, 1914, at the new Grand Central Palace. The exhibits will include an assembly of representative displays of appliances, methods and products in the fields of industrial, mechanical, governmental, educational and household efficiency. The latest practice, for instance, in building construction will be shown by the Equitable Building Corporation. The exposition will be under the auspices of the Efficiency Society which now has a membership of approximately 1,000.

Relationship Between Architects and the Massachusetts District Police.

By LINUS G. FOSTER, Architect.

Certain States in this country seem to have been more favored than others in regard to the inspection of public buildings and it is unfortunate that we find that Massachusetts has been, for some time, the target for considerable comment by her sister States. In that State there has been at times a sharp diversity between architects and the district police, especially in connection with the erection of theatres and moving picture halls, mainly on the subject of ventilation. According to a ruling of the district police, ventilation must in all cases be downward, which requires the admission of fresh air at the top of auditoriums and the removal of the foul and vitiated air at the floor level.

This is a requirement which has been in vogue for a long time, but which is just now a subject of considerable discussion among architects, engineers and theatre owners throughout the country. In the case of a theatre, for instance, with balconies and having a seating capacity of 700, the foul and devitalized air from such balconies must be carried downward upon the audience to be inhaled over again before it passes out through the vent ducts at the floor level. Where architects and engineers have been criticized by their clients for this practice, they have appealed to the district police for a ruling that would permit upward ventilation, such as is in vogue in many other progressive States.

It has been demonstrated to the district police that under such conditions, we are unable to satisfy our clients and the public.

Mr. Dooley, it will be remembered, had no books but the Bible and Shakespeare. Asked if he read them constantly, he replied, "I nivir rade thim, I use them for purposes of defince. They stand between me and all modern progress. I built thim up into a kind of a breakwother, and I set behind it calm and contint while Hall Caine rages without."

The writer has erected several motion picture theatres equipped with upward ventilation, in which the fresh air is admitted

to the auditorium through direct-indirect radiators, arranged along the walls, and the foul or devitalized air removed at the ceiling by autoforce air pumps, with excellent success, both from an engineering and economic standpoint.

LEGAL DECISIONS

The Ventilator is Part of Freehold.

Action was brought by a ventilator company against the owner of a building for the conversion of a ventilator which the plaintiff had installed in the building by virtue of a contract made with a tenant therein, Rose, a restaurateur. The ventilator was about 35 ft. long and extended from the kitchen on the first floor on the outside of the building to its top. The main part of it was 16 to 18 in. in diameter, and was fastened to the brickwork of the building by a considerable number of bolts or rivets. By agreement between the plaintiff and Rose the ventilator was to remain the property of the plaintiff until paid for, but the trial judge refused to find that this was with the knowledge or consent of the defendant, and the contrary was therefore necessarily assumed by the court. The ventilator remained upon the premises after the termination of Rose's tenancy. The defendant contended that the ventilator and its several parts were personal property. There was some evidence to indicate that the use of the ventilator was intended to be restricted to the building in which it was fastened. If it were treated as a trade fixture, it was not removed during the term of the tenancy, and hence, upon expiration of the term, if attached to the building, it became a part of the freehold.—Natural Autoforce Ventilator Co. vs. Winslow, Massachusetts Supreme Court, 102 N. E. 705.

Water Heater Patent.

The Ruud patent, No. 761,409, for a gas burner of the Bunsen type, for use particularly in automatic water heaters, and most particularly in those which use natural gas, the supply of which is controlled both by a water valve and a thermostatic valve, is held to disclose invention and to be vaild. It is also held infringed by the Frampton patent, No. 980,236. The Ruud patent, No. 875,218, for a gas burner, is held void for lack of invention, in view of the prior art.—Ruud Mfg. Co. vs. Pittsburg Water Heater Co., C. C. A., 205 Fed. 372.

Franchise—Electric Current for Heating Included.

The United States Supreme Court holds that a municipal grant of a franchise to do a general electric light business must be deemed in Nebraska to include the distribution of electric current for power and heating as well as for lighting, that having been the practical interpretation of the franchise by both the city and the grantee, in view of the decisions of the Nebraska courts that the doctrine of practical interpretation of contracts is applicable to public-service franchises.—Old Colony Trust Co. vs. City of Omaha, 230 U. S. 100, 33 Sup. Ct. 966.

Warranty, Expressed and Implied.

The owner of a house had a steam-heating system with about 550 sq. ft. of radiation. Desiring to install a boiler of greater capacity than the one in use, he examined a boiler known as the Ideal No. 046, manufactured by the American Radiator Company, and which was in the home of Richard Scott, to which was attached at that time about 600 sq. ft. of radiation. Wishing to install "a duplicate of the Scott job," he applied to a firm for a price to furnish and install the same, and in reply he received a letter stating: "We will furnish and install a No. S-25-5 Ideal Sectional Steam Boiler as manufactured by the American Radiator Company of Chicago, complete, for the sum of $213.60. This includes disconnecting the old boiler now in place, cleaning and piping brick in the cellar, making proper connections from steam mains and returns, and new boiler covered with asbestos cement 1½ in. thick. The 046 steam boiler, same as installed in Mr. Scott's residence, is not manufactured only on request. The No. S-25-5 taking its place, but same can be had at an additional cost of $55 to the above price." In an action for breach of warranty, the plaintiff, the owner of the house, testified that he saw the writer of the letter, who stated that the 25 was an improvement on the 046. This was denied by the defendant. He testified that he stated to the plaintiff that he would not guarantee a boiler installed under the existing conditions of piping in the house, and that he did not guarantee to heat the house. It was held that this completely negatived the idea of an implied warranty and it should not have been submitted to the jury. But as the contract for the sale of the boiler consisted only of the letter written by the sellers and the buyer's alleged acceptance in an oral conversation, the letter did not constitute a complete written contract, so as to preclude parol evi-

dence of an express warranty not contained in the letter. On instruction on the measure of damages, that the jury would have to rely on the evidence before them and allow such sum as reasonable men would decide, was held insufficient for failure to inform the jury explicitly as to the measure of damages applicable. Judgment for the plaintiff was reversed and a new trial granted.—Potter vs. Shields, Michigan Supreme Court, 140 N. W. 500.

For Standard Requirements for Boiler Installations.

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	New York.	Boston.	Pittsburg.	Chicago.	St. Louis
Highest temperature, degrees F.	58	63	72	60	68
Date of highest temperature	30	30	29	28	28
Lowest temperature, degrees F.	—5	—9	3	4	15
Date of lowest temperature	14	13	14	12	12
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Date of greatest daily range	25	25	14	29	29
Least daily range, degrees F.	3	4	5	4	5
Date of least daily range	4	20	4	1	5
Mean temperature for month, degrees F.	31.4	29	34	32.4	39.7
Normal mean temperature for month, deg. F.	30.2	27	30.7	23.7	31
Total rainfall, inches	3.69	3.26	2.41	3.01	2.21
Total snowfall, inches	1.2	10.3	17.3	14.8	6.5
Normal precipitation, this month, in.	3.79	3.82	2.87	2.0	2.27
Total wind movement, miles	14982	9682	10558	10216	10023
Average hourly wind velocity	20.1	12.9	14.2	13.7	16.2
Prevailing direction of wind	N.W.	N.W.	S.W.	S.W.	N.W.
Number of clear days	6	5	2	4	8
Number of partly cloudy days	6	8	8	4	11
Number of cloudy days	19	18	21	23	12
Number of days on which rain fell	13	10	17	13	9
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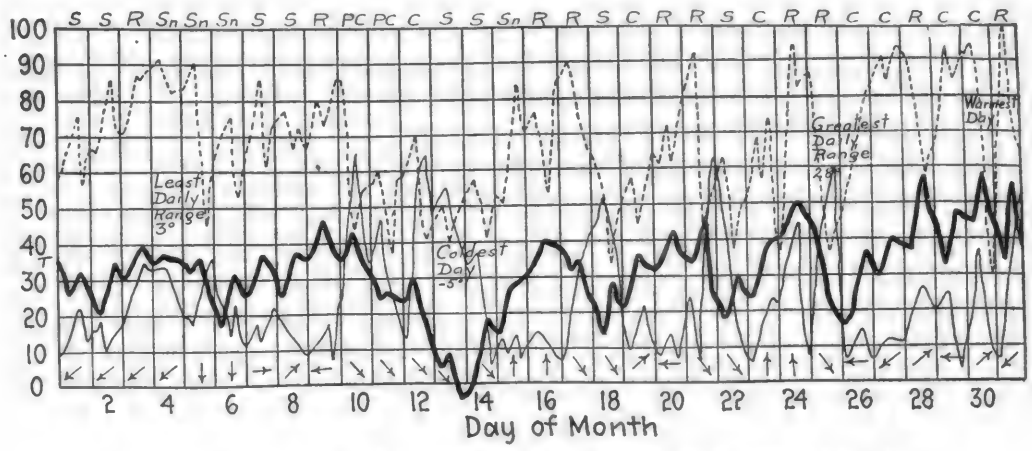
Snow on ground at end of month, in.	..	..	Trace	9.3	2.0



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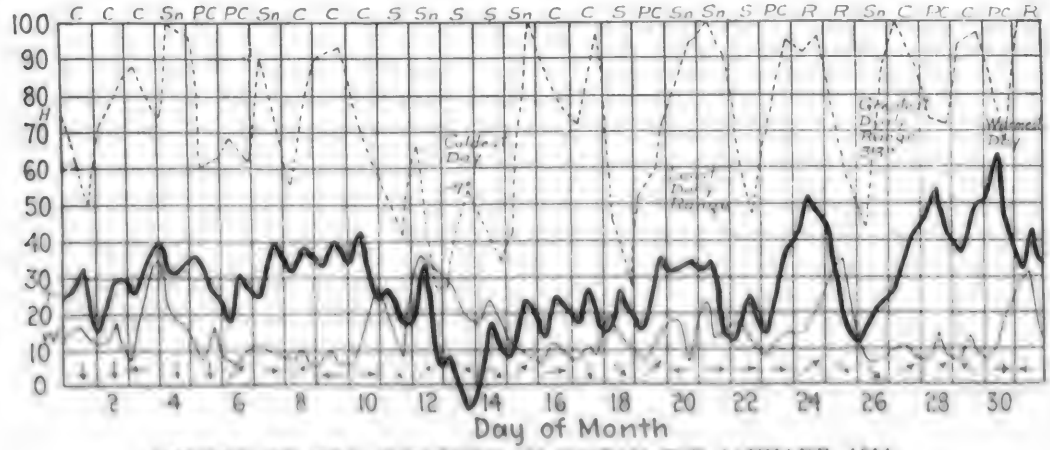

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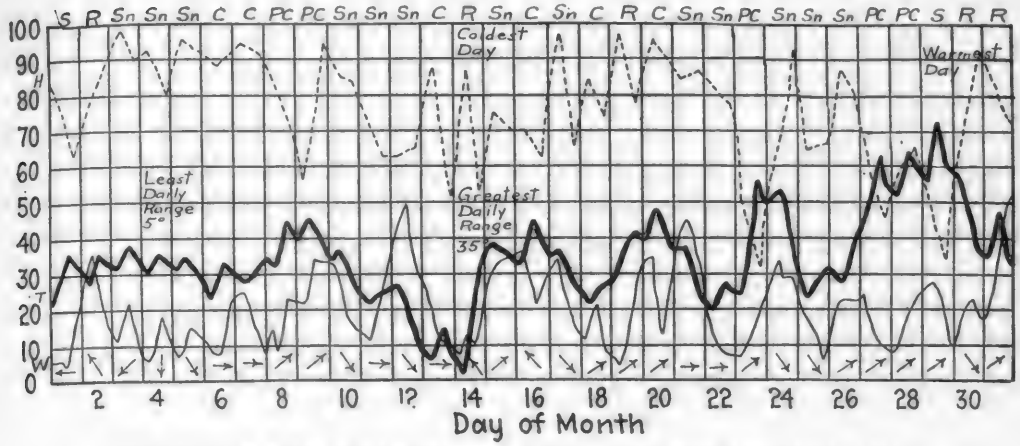

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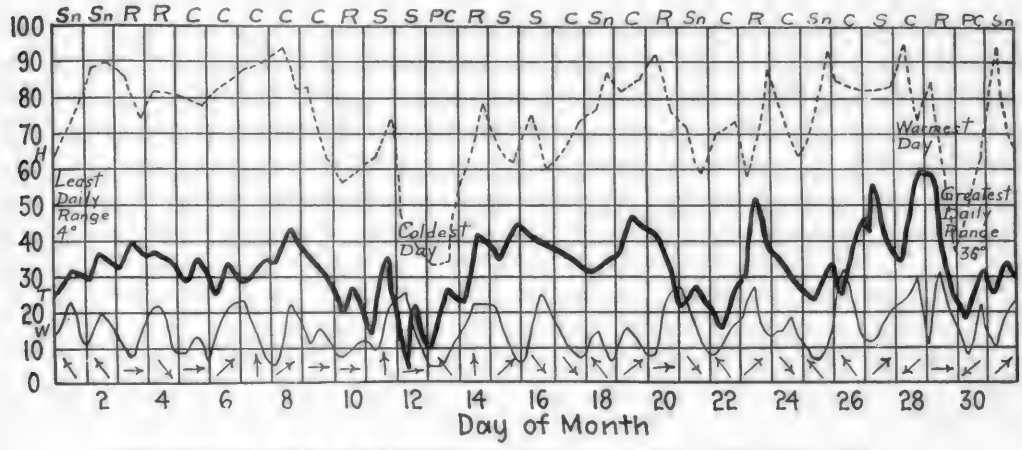

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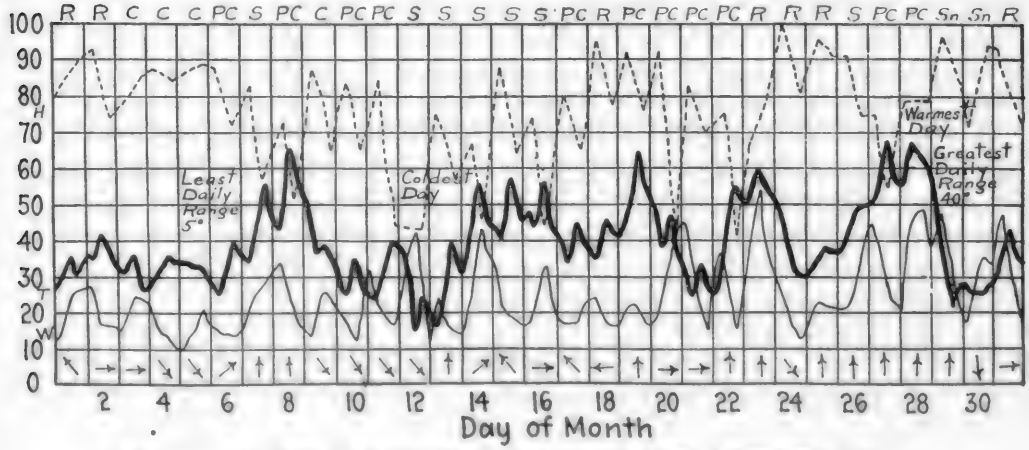

RECORD OF THE WEATHER IN ST. LOUIS FOR JANUARY, 1914.

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F.
Light lines indicate wind in miles per hour.
Broken lines indicate relative humidity in percentage from readings taken at 8 A. M. and 8 P. M.
S—clear, P C—partly cloudy, C—cloudy, R—rain, Sn—snow.
Arrows fly with prevailing direction of wind.

How large should the box be and how much surface should there be in the coil with the water supply at 65° F.?

ANSWER: Inasmuch as the air is 70° F., there will be no appreciable evaporation from the water surface unless the water is boiled at 212° F., forming steam at atmosphere. The size of the box has little or nothing to do with the operation except that it must be sufficiently large to hold the immersed steam coil. A better plan would be to steam jacket the bottom of the box and possibly the sides in the same manner as a kettle used for steam cooking in kitchens. Care must be used in building it to stay it and make it sufficiently strong to withstand the maximum pressure required.

The total heat in the water at 65° F. above 32° F. is 33 B.T.U. The total heat in the steam at 212° F. is 1,150 B.T.U. Each grain of moisture evaporated will require 1,150 — 33 = 1,117 B.T.U. and

$$\frac{24{,}000 \times 2 \times 1{,}117}{70{,}000 \text{ grains}} = 7{,}670 \text{ B.T.U. per hour.}$$

Prime heating surface immersed in water as indicated will give up about 200 B.T.U. per degree difference per hour. Steam at 5 lbs. gauge is about 227° F, and, with water at 212° F., 227 — 212 = 15°; 7,670 ÷ 3,000 = 25.5 sq. ft. of heating surface.

The grains of moisture and relative humidity will be regulated by the flow of steam in the coil. The size of the box and extent of the water surface will determine the amount of ebulition from the box. If the surface is ample, the water will not boil so rapidly or noisily to supply the requisite amount of vapor. In other words, comparatively shallow pan will give the quietest operation.

As good results can be obtained by injecting the steam directly into the air, if it were not for the smell accompanying most vapor from power boilers and exhaust steam from engines. The pan of clean water will eliminate the odor.

Building Operations in January.

Building permits totaling $37,152,920 in value for 56 cities, were issued in January, 1914, according to The American Contractor, as compared with a total of $40,361,494 for the corresponding month of 1913. New York City reported a decrease of 12 per cent., Chicago a decrease of 22 per cent., Philadelphia, a decrease of 14 per cent., St. Louis an increase of 38 per cent., Pittsburgh, an increase of 204 per cent.

ELBERT HUBBARD ON TRADE PAPERS.

Advertising—Its Relation to Trade Papers.

(This series of articles commenced in the September, 1913, issue.)

He who imagines that modern advertising is the exploitation of the public is a biouspidati diplidocus, and would do well to come out of his comatose state and cur rycomb his convolutions.

Advertising is information as to who you are, where you are, and what you have to offer in the way of skill, talent or commodity.

To stand still is to retreat.

To worship the good Terminus is to have the Goths and Vandals that skirt the borders of every successful venture, pick up your Herminii and carry them inland, long miles, between the setting of the sun and his rising.

To hold the old customers you must get out after the new

When a fellow thinks he is big enough, there is lime in the bones of the boss, and a noise like a buccaneer is heard in the offing.

The reputation that endures, or the institution that lasts, is the one that is properly advertised.

The only names in Greek History that we know are those which Herodotus and Thucydides graved with deathless styli.

The men of Rome who live and tread the boardwalk are those Plutarch took up and writ their names large on human hearts.

All that Plutarch knew of Greek heroes was what he read in Herodotus.

Life, now, is human service.

To deceive is to beckon for the Commissioner in Bankruptcy.

Nothing goes but truth.

We know this—because for over two thousand years we have been trying everything else.

Academic education is the act of memorizing things read in books, and things told by college professors who got their education pretty much in the same way.

It is easier to be taught than to attain.

It is easier to accept than to investigate.

It is easier to follow than to lead—usually. Yet we are all heir to peculiar, unique and individual talents, and a few men are not content to follow.

"Truth," says Dr. Charles W. Elliot, "is the new virtue,"

"Let the truth be known about your business" idea has inspired the best firms to tell of their products to Trade Paper subscribers.

The only man who should not advertise is the one who has nothing to offer in the way of service, or one who cannot make good.

All such should seek the friendly shelter of oblivion where dwell those who, shrouded in Stygian shades, foregather gloom and are out of the game.

Not to advertise is to be nominated for membership in the Down-and-Out-Club.

The Adscript and the Adcrafts are opposition societies to the Mummy Trust.

About the best we can say of the days that are gone, is that they are gone.

The Adscripts and the Adscrafts look to the East. They worship the rising sun. The oleo of authority does not much interest them. They want the Kosmic Kerosene that supplies Caloric.

A good Advertiser is never either a philophraster or a theologaster—he is a pragmatist. He seeks the good for himself, for his customers, and for the whole human race.

The science of advertising is the science of psychology.

And psychology is the science of the human heart.

Advertising interest, inspires, educates, sometimes amuses—informs, and thereby uplifts and benefits, lubricating existence and helping the old world on its way to Celestial City of Fine Minds.

And especially does the Trade Paper know the Science of Advertising.

First, the Trade Paper carries no shady or uncertain advertising. Everything that treads the border line of bunco is eliminated.

The subscriber to a trade paper is, or should be, as much interested in the ads as in the text. Both inform, uplift and inspire.

The Trade Paper is in partnership with its subscribers—the interests of each are identical. The Trade Paper exists for this one reason—to render a tangible aid to the subscriber.

To amuse him, tell him of the embezzlement in Alaska, the elopement in Florida, or the seduction in California—these things are not enough. The subscriber must get ideas that he can use in his business—and any subscriber who studies the advertisements of his Trade Paper, does.

(*Copyright,* 1914, *Kovnat.*)

Efficiency Exposition and Conference.

The first national efficiency exposition and conference will be held in New York, April 4-11, 1914, at the new Grand Central Palace. The exhibits will include an assembly of representative displays of appliances, methods and products in the fields of industrial, mechanical, governmental, educational and household efficiency. The latest practice, for instance, in building construction will be shown by the Equitable Building Corporation. The exposition will be under the auspices of the Efficiency Society which now has a membership of approximately 1,000.

Relationship Between Architects and the Massachusetts District Police.

By Linus G. Foster, Architect.

Certain States in this country seem to have been more favored than others in regard to the inspection of public buildings and it is unfortunate that we find that Massachusetts has been, for some time, the target for considerable comment by her sister States. In that State there has been at times a sharp diversity between architects and the district police, especially in connection with the erection of theatres and moving picture halls, mainly on the subject of ventilation. According to a ruling of the district police, ventilation must in all cases be downward, which requires the admission of fresh air at the top of auditoriums and the removal of the foul and vitiated air at the floor level.

This is a requirement which has been in vogue for a long time, but which is just now a subject of considerable discussion among architects, engineers and theatre owners throughout the country. In the case of a theatre, for instance, with balconies and having a seating capacity of 700, the foul and devitalized air from such balconies must be carried downward upon the audience to be inhaled over again before it passes out through the vent ducts at the floor level. Where architects and engineers have been criticized by their clients for this practice, they have appealed to the district police for a ruling that would permit upward ventilation, such as is in vogue in many other progressive States.

It has been demonstrated to the district police that under such conditions, we are unable to satisfy our clients and the public.

Mr. Dooley, it will be remembered, had no books but the Bible and Shakespeare. Asked if he read them constantly, he replied, "I nivir rade thim, I use them for purposes of defince. They stand between me and all modern progress. I built thim up into a kind of a breakwother, and I set behind it calm and contint while Hall Caine rages without."

The writer has erected several motion picture theatres equipped with upward ventilation, in which the fresh air is admitted

to the auditorium through direct-indirect radiators, arranged along the walls, and the foul or devitalized air removed at the ceiling by autoforce air pumps, with excellent success, both from an engineering and economic standpoint.

LEGAL DECISIONS

The Ventilator is Part of Freehold.

Action was brought by a ventilator company against the owner of a building for the conversion of a ventilator which the plaintiff had installed in the building by virtue of a contract made with a tenant therein, Rose, a restaurateur. The ventilator was about 35 ft. long and extended from the kitchen on the first floor on the outside of the building to its top. The main part of it was 16 to 18 in. in diameter, and was fastened to the brickwork of the building by a considerable number of bolts or rivets. By agreement between the plaintiff and Rose the ventilator was to remain the property of the plaintiff until paid for, but the trial judge refused to find that this was with the knowledge or consent of the defendant, and the contrary was therefore necessarily assumed by the court. The ventilator remained upon the premises after the termination of Rose's tenancy. The defendant contended that the ventilator and its several parts were personal property. There was some evidence to indicate that the use of the ventilator was intended to be restricted to the building in which it was fastened. If it were treated as a trade fixture, it was not removed during the term of the tenancy, and hence, upon expiration of the term, if attached to the building, it became a part of the freehold.—Natural Autoforce Ventilator Co. vs. Winslow, Massachusetts Supreme Court, 102 N. E. 705.

Water Heater Patent.

The Ruud patent, No. 761,409, for a gas burner of the Bunsen type, for use particularly in automatic water heaters, and most particularly in those which use natural gas, the supply of which is controlled both by a water valve and a thermostatic valve, is held to disclose invention and to be vaild. It is also held infringed by the Frampton patent, No. 980,236. The Ruud patent, No. 875,218, for a gas burner, is held void for lack of invention, in view of the prior art.—Ruud Mfg. Co. vs. Pittsburg Water Heater Co., C. C. A., 205 Fed. 372.

Franchise—Electric Current for Heating Included.

The United States Supreme Court holds that a municipal grant of a franchise to do a general electric light business must be deemed in Nebraska to include the distribution of electric current for power and heating as well as for lighting, that having been the practical interpretation of the franchise by both the city and the grantee, in view of the decisions of the Nebraska courts that the doctrine of practical interpretation of contracts is applicable to public-service franchises.—Old Colony Trust Co. vs. City of Omaha, 230 U. S. 100, 33 Sup. Ct. 966.

Warranty, Expressed and Implied.

The owner of a house had a steam-heating system with about 550 sq. ft. of radiation. Desiring to install a boiler of greater capacity than the one in use, he examined a boiler known as the Ideal No. 046, manufactured by the American Radiator Company, and which was in the home of Richard Scott, to which was attached at that time about 600 sq. ft. of radiation. Wishing to install "a duplicate of the Scott job," he applied to a firm for a price to furnish and install the same, and in reply he received a letter stating: "We will furnish and install a No. S-25-5 Ideal Sectional Steam Boiler as manufactured by the American Radiator Company of Chicago, complete, for the sum of $213.60. This includes disconnecting the old boiler now in place, cleaning and piping brick in the cellar, making proper connections from steam mains and returns, and new boiler covered with asbestos cement 1½ in. thick. The 046 steam boiler, same as installed in Mr. Scott's residence, is not manufactured only on request. The No. S-25-5 taking its place, but same can be had at an additional cost of $55 to the above price." In an action for breach of warranty, the plaintiff, the owner of the house, testified that he saw the writer of the letter, who stated that the 25 was an improvement on the 046. This was denied by the defendant. He testified that he stated to the plaintiff that he would not guarantee a boiler installed under the existing conditions of piping in the house, and that he did not guarantee to heat the house. It was held that this completely negatived the idea of an implied warranty and it should not have been submitted to the jury. But as the contract for the sale of the boiler consisted only of the letter written by the sellers and the buyer's alleged acceptance in an oral conversation, the letter did not constitute a complete written contract, so as to preclude parol evi-

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Number of clear days	6	5	2	4	8
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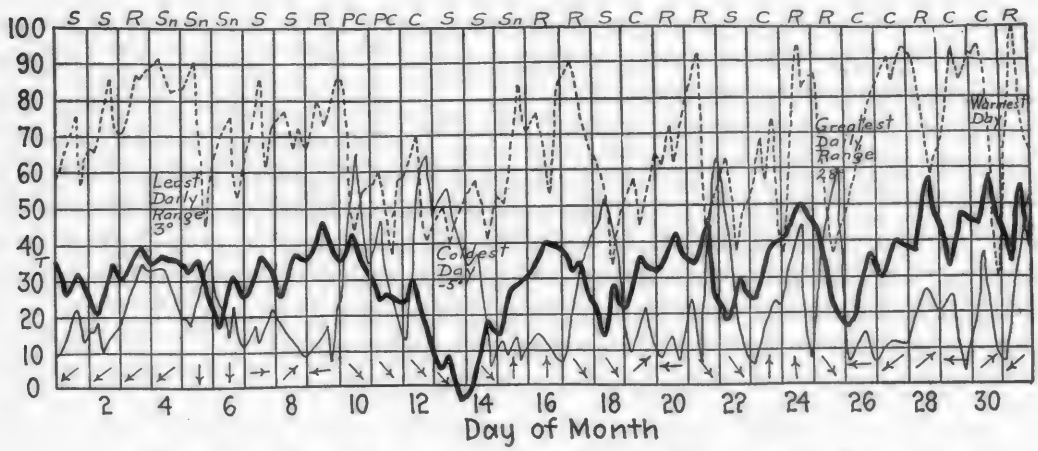

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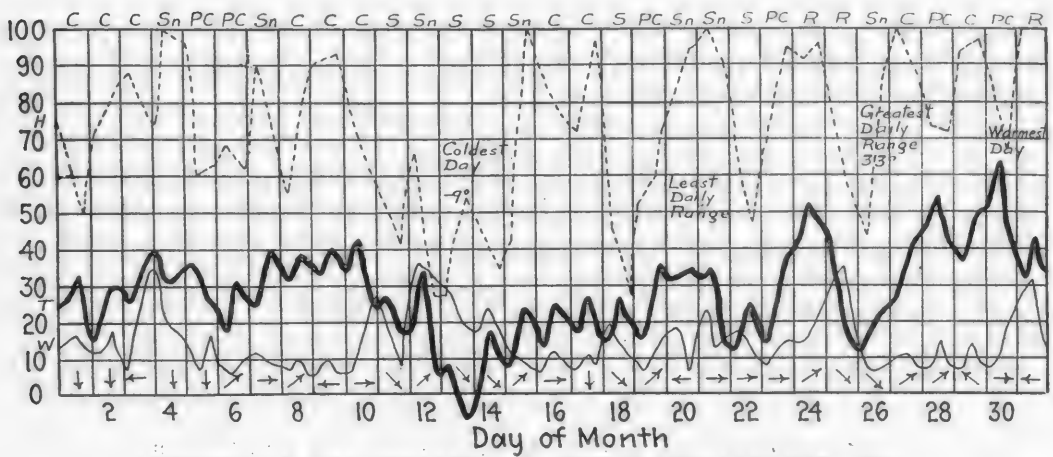

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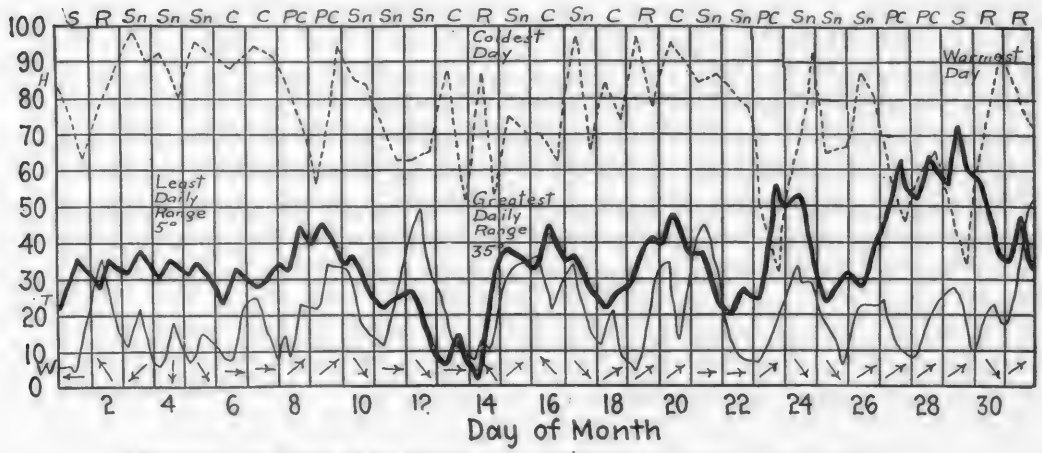

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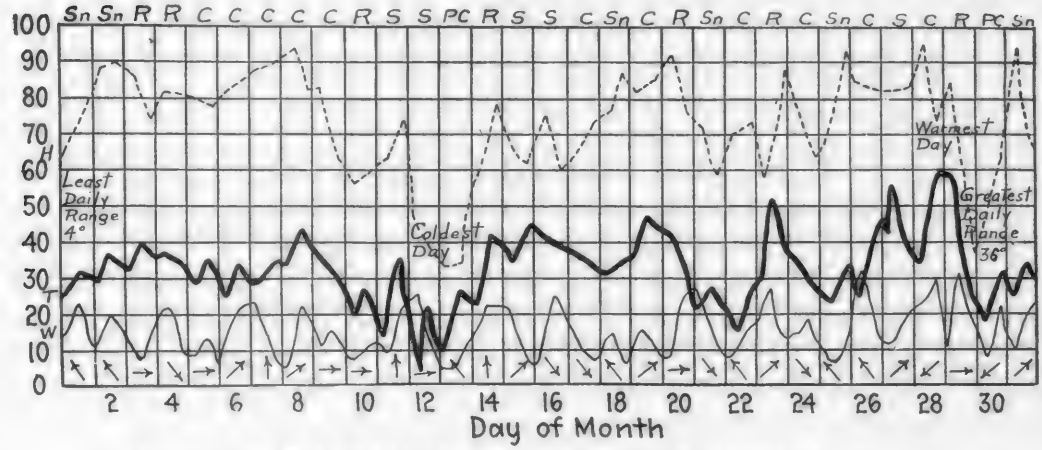
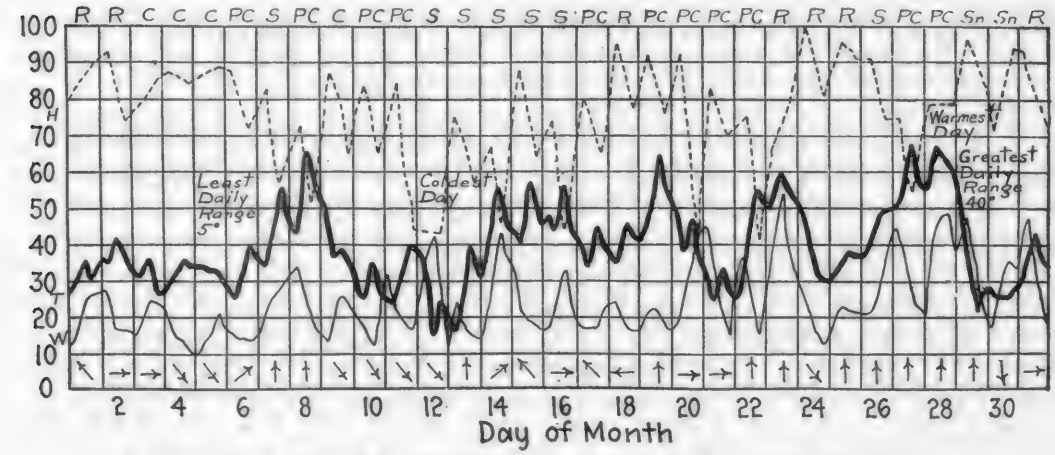


RECORD OF THE WEATHER IN CHICAGO FOR JANUARY, 1914.



RECORD OF THE WEATHER IN ST. LOUIS FOR JANUARY, 1914.

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F.
Light lines indicate wind in miles per hour.
Broken lines indicate relative humidity in percentage from readings taken at 8 A. M. and 8 P. M.
S—clear, P C—partly cloudy, C—cloudy, R—rain, Sn—snow.
Arrows fly with prevailing direction of wind.

New York Chapter Discusses Fan Selection.

A paper on "Fan Selection," by Prof. Frank L. Busey, of Buffalo,, N. Y., in which the speaker traced the development of the present types of centrifugal fans and also took up the principles which govern the selection of fans for given conditions, was presented at the February meeting of the New York Chapter, February 16.

The centrifugal fan, said Prof. Busey, has been built in different forms for over 200 years and even as far back as 1847 a Mr. Buckle presented before the Institution of Mechanical Engineers data for the design of fans which do not differ greatly from the practice at the present time. In 1872 the first complete treatise on the theory of the centrifugal fan was published by the engineer, Daniel Murgue, and this theory is still accepted by our best authorities on fan performance.

The speaker said that these earlier fans were probably used for the most part for mine ventilation and later for the ventilation of tunnels. At first they were used simply for exhausting and were not fitted with housings. In this way only the centrifugal velocity was used and no benefit was derived from the rotational velocity.

Slides were shown of the early types of fans, including the Guibal fan, invented about 60 years ago, with its distinctive feature of a discharge tube on the fan outlet, used to reduce the velocity of discharge and so to lessen the loss of head due to discharging at a high velocity.

Early types of fans in which curved blades were used were shown, such as the d'Anthonay fan, with both forward and backward curved blades, and with a housing of circular section instead of the scroll shape now generally used.

A further development was shown in the Capell fan, consisting of two rotors, one within the other, having the same axis and revolving at the same angular velocity. In this type the blades all curve backward. This was followed by the Rankine fan, which depends on the spiral or scroll shape of the housing to reduce the velocity of discharge rather than on the chimney outlet.

The Rateau type, which was the next shown, was declared by the speaker to be the most efficient of the early types, test results showing mechanical efficiencies of from 70% to 75% and even approaching 80%. It is expensive, however, to build.

FIRST OF THE MULTIVANE FANS.

One of the first of the multivane fans using short curved blades was brought out in 1884 by Prof. Ser of Paris. This type, as shown, consists of a central revolving plate, on both sides of which, at the edge, are mounted a series of forward curved vanes, thirty-two being mounted on each side of the plate. The speaker called attention to the unobstructed inlet chamber of this type and to the feature that the tip of the blade is advanced beyond the heel. Both of these features were sustained in a recent patent decision.

What the speaker declared to be the direct ancestor of the modern narrow blade multivane fan is that patented by Fournier and Cornu in 1896. This fan has curved blades mounted on a central revolving disc, and also has the unobstructed inlet.

The speaker then showed sectional views of the fan brought out by M. Levet in 1890 in which use was made of guide vanes, both in the inlet and outlet of the fan. Prof Busey stated that he had made tests of modern fans equipped with these guide vanes, but had not found that the vanes added anything to the efficiency of the fans, but in some cases retarded the air flow.

THE SIROCCO FAN.

This brought the speaker to the Davidson fan and views were shown of the older drawings of this type, known as the Sirocco fan. Modified designs were also displayed showing, for instance, changes in the arrangement of the blades so that they do not now project within the inlet circle. Also the pipe connection at the fan outlet now comes to about the center of the fan housing so that a much larger pipe, with the same size outlet, is used than with the original design. In this way the pipe connection is increased to practically 50% larger than the discharge area by extending the outlet connection below the point of cut-off.

NIAGARA CONOIDAL FAN.

The Niagara conoidal fan, which was next shown, was described by the speaker as the most recent development in the design of multivane curved blade fans. The speaker emphasized two special features, the diverging cone effect, which is brought back into the fan housing, giving an actual lower outlet velocity and consequent higher static pressures, and the unusual design of the wheel. The name is derived from the prevalence of conical sections used in this design, the blast wheel forming the frustrum of a cone and the blades being curved over the tapering surface of a cone. The speaker said that special care had been taken in

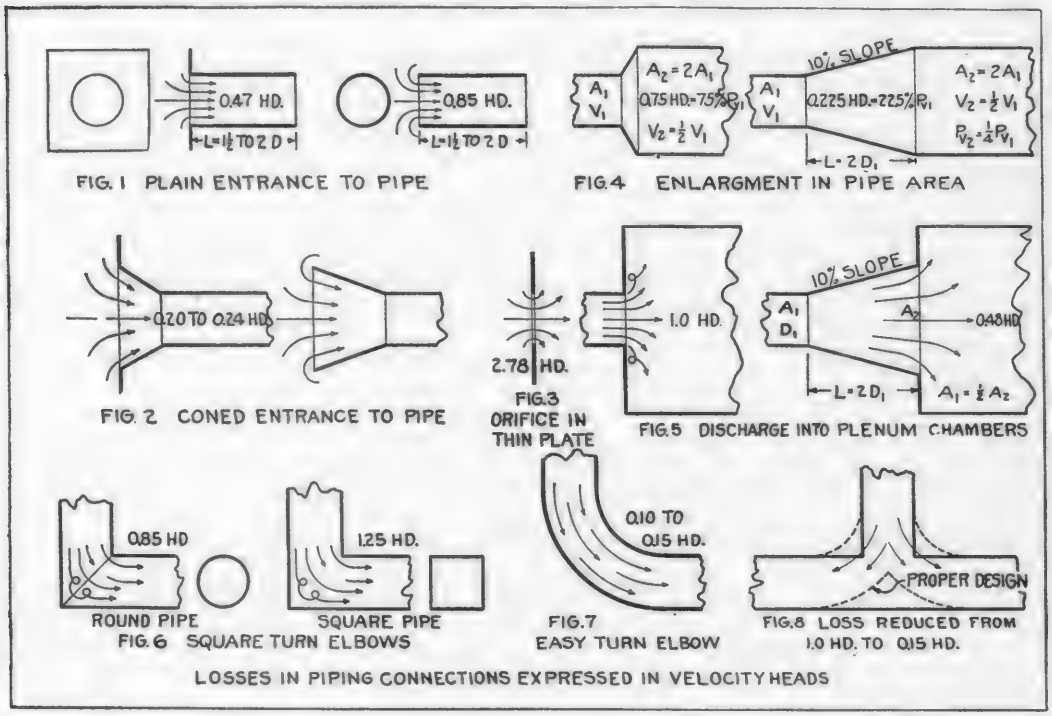
the design to the angle of incidence at the heel of the blade, this angle being varied across the face of the blade to care for the difference in radial velocities. The securing of the proper angle of incidence, he said, reduces the loss by shock at the heel of the blade.

Prof. Busey showed by charts the effect on the velocity by curving the blades forward or backward, the bending of the blades backward being of advantage when it is desired to direct connect a fan to a high speed unit without developing a corresponding high pressure.

COMPARISON OF STRAIGHT BLADE AND MULTI-BLADE FANS.

Prof. Busey also brought out the point that centrifugal fans with straight blades as ordinarily built do not give as high an efficiency as the multivane type, owing to the fact that they are designed for large capacities rather than for high efficiencies, but that if these long blade fans are built according to special design, they may be made to give greater efficiency than may be obtained from the short curved blade fans. This, however, calls for a tall, narrow fan with the inlet diameter smaller than that used on the standard fan, which makes them more expensive than the ordinary commercial steel plate fan. This, he said, accounts for the fact that special tall, narrow fans are frequently used for induced draft work, partly because the narrow wheel makes a shorter overhang on the fan bearing, and partly because they may be operated at lower speed, making them more suitable for connection to steam engines.

The speaker called attention to the pressure characteristics of the two types of fans which, he said, was of the greatest importance in their selection. In a straight blade fan, the pressure tends to build up as the load on the fan is reduced, while operating at constant speed. Thus, if such a fan be used to supply forced draft to a boiler, and due to the thickening of the fuel bed the discharge from the fan should be throttled, the pressure will increase, which is the condition to be desired. On the other hand, with the forward curved blade, as the



EFFECTS OF DIFFERENT PIPING CONNECTIONS USED WITH FANS.

Fig. 1. Entrance loss to a straight pipe, either from a chamber or with a projecting pipe.
Fig. 2. Possible saving by having this entrance made cone-shaped.
Fig. 3. Action of air in passing through orifice in thin plate.
Figs. 4 and 5. Losses in velocity head and possible savings in pressure by using a properly-designed diverging cone or nozzle, instead of an abrupt change in section.
Fig. 6. Head lost in square-turn elbows of both round and square section.
Fig. 7. Effect of easy-turn elbow.
Fig. 8. Possible saving that may be made by changing the construction as indicated by the dotted line.

air delivery is decreased the pressure will fall off. Another case cited by the speaker as of importance is when a fan is required to operate part of the time at a considerable overload, yet a definite pressure must be maintained. For such a case the chances are that a straight blade fan would be the one to use.

The speaker then showed some of the more common piping connections used with fans.

Prof. Busey concluded by presenting some of the new tables that are now being published by fan manufacturers showing the characteristics of given fans for other than rated capacities. He supplemented this with typical instances showing how the tables were to be used, especially in the selection of different sizes of fans for any desired duty and to tell at a glance the corresponding speed and horse-power. For instance, he said, where quiet operation is essential, an outlet velocity of from 1,800 to 2,200 ft. per minute should be used. In the case of a shop where some noise is not so objectionable, an outlet velocity of perhaps 2,800 to 3,400 ft. may be used. By a comparison of the three sets of data he presented, he showed how either one of three fans may be selected for the same duty.

He presented what was to many a new idea in stating that the relations holding in the case of a fan are directly comparable to those in the use of electricity. There is first the relation of voltage drop or voltage resistance across the terminals (I^2) a measure of quantity times the coefficient of resistance (R), this product being known as the I^2R loss. In the same way, we have the static resistance on the fan which is equal to the square of the air quantity times the coefficient or resistance of the system. By changing the position of the factors in this question the coefficient of resistance of any system is equal to the static pressure divided by the square of the air quantity. Also the air handled will be a definite fixed quantity, equal to the square root of the static pressure divided by the coefficient of the system. The static pressure is a constant for any given installation, being a measure of the static resistance against which the fan is to operate. Thus the static resistance on a fan drawing through six sections of a Buffalo standard pipe heater would be 0.57 in.

President D. D. Kimball, who presided at the meeting, announced that the subject for the March meeting would be "Schoolhouse Heating and Ventilation," the speakers scheduled to speak on the topic being Frank G. McCann, engineer for the New York City Department of Education; George W. Knight, engineer for the Newark (N. J.) Department of Education, and D. D. Kimball. The subject for the April meeting will be "Hot Water Heating," and the special speakers will be J. A. Almirall, Douglas Sprague and C. R. Place.

The chapter's entertainment committee, which had charge of the entertainment programme at the society's annual meeting, reported receipts of $711 and expenditures of $702.97, leaving a balance of $8.03. The committee was given a vote of thanks by the chapter.

President Kimball appointed as a nominating committee to nominate officers of the chapter for the ensuing year: Frank R. Chapman, James A. Donnelly, Homer Addams, A. M. Feldman and C. E. Pearce.

Illinois Chapter Visits Experimental School Room.

An inspection of the school room at the Chicago Normal School, where ventilation experiments have been conducted for some time by the Chicago Ventilation Commission, was made by the Illinois Chapter on the occasion of its February meeting. The chapter was accompanied by members of the commission and by members of the board of education, the guests including Dr. George B. Young, commissioner of health; Lewis E. Larson, secretary of the board of education; John Howatt, chief engineer for the board, and the following members of the board: Charles S. Peterson, Robert J. Roulston, John J. Sonseby, Mrs. Florence Vosbrink and Gertrude Howe Britton. The party first had dinner at the Great Northern Hotel and then proceeded by special car on the South Side elevated to the school.

On arrival at the Chicago Normal School, the chapter and guests were met by Prof. John W. Shepherd, head of the science department, who showed the arrangement of the experimental room and explained the experiments already conducted by the commission, together with its further plans. The principal feature of the room, as now arranged, is the false ceiling and floor, the two spaces acting as air chambers above and below the room. In this connection, a number of 3-in. pipes are carried up from the floor to about the level of the pupils' faces when seated and open under each desk, giving individual ventilation.

Prof. Shepherd described the work of the commission at length, covering the points brought out in his paper on the subject (published in the HEATING AND VENTILATING MAGAZINE for December, 1913). He spoke of the theory on which the commis-

sion is now at work, based on the idea that there may be a loss in attempting to heat and ventilate a room with the same air. He also referred to the experiments with toy balloons filled with hydrogen gas to determine the course and velocity of air currents.

In the discussion which followed it was brought out that the matter of architectural and constructive science is destined to play an important part in the ventilating arrangements of the future. A comment by Dr. Young, that was received with interest, was that he believed a heating and ventilating system such as that installed in the experimental room could be operated at less expense than the systems generally in use.

George Beaumont, a Chicago architect, recounted his observations while on a trip to Pompeii, where he found buildings built of hollow tile, often with floors of the same construction. It was evident, he said, that these hollow walls and floors had been used in connection with heating systems, the spaces acting as chimney flues while at the same time serving to heat the buildings.

Samuel R. Lewis, the new president of The American Society of Heating and Ventilating Engineers, spoke of the wide attention which the Normal School experiments have attracted and of the effect they have already had in shaping ventilation ordinances in various cities.

Dr. E. Vernon Hill, chief inspector of the ventilation division of the Chicago Health Department, presented additional facts and observations made in connection with the ventilation of picture theatres in Chicago.

Resignation of Edwin A Scott.

The many friends of Edwin A. Scott, secretary of the American Society of Heating and Ventilating Engineers, will learn with regret of his illness which has compelled him to resign the secretaryship of the society. Mr. Scott has also relinquished his position as managing editor of "The Metal Worker," of New York, and has gone to Calgary, Alberta, Canada, where it is hoped the cold climate will restore his health.

One hundred and ninety-one conventions, which will be attended by delegates from all parts of the world, have voted to hold their sessions in San Francisco in 1915. The organizations are varied in character and include civic, religious, social service, educational, fraternal, business, labor, commercial, agricultural, live stock and scores of other interests.

NATIONAL ASSOCIATION OF MASTER STEAM AND HOT WATER FITTERS

Date Set for Next Annual Convention.

The next annual convention of the National Association of Master Steam and Hot Water Fitters will be held at Atlantic City, N. J., June 10-13, 1914.

Wisconsin State Association.

An attendance of 50 members out of a total of 60 marked the fourth annual meeting of the Wisconsin Association of Master Steam and Hot Water Fitters, which was held in Madison, Wis., January 20. The following officers were elected:

President, Hugo O. P. Franke, Milwaukee; vice-president, James Sullivan, Stevens Point; secretary, Albert Luebke, Milwaukee; treasurer, Fred Kaufmann, Milwaukee; sergeant-at-arms, Otto Biefeld, Watertown. Board of directors: E. H. Sonnemann, Sheboygan; Frank Kraft, Kenosha; George F. Reeke, Green Bay, and James Smollen, Racine. F. H. Meadows was re-elected recording-secretary.

Iowa State Association.

The first annual meeting of the Iowa Association of Master Steam and Hot Water Fitters, held January 15, at Keokuk, took up the work of perfecting its organization and a committee was appointed to draft a constitution and by-laws, to be presented at the next regular meeting in May. The temporary officers elected last summer will be continued until the final organization is effected. The present officers are: President, John F. Garvey, Mason City, and secretary, Robert Knauer, Des Moines.

National Fresh Air for All Association.

With the purpose of having plenty of fresh air supplied to every gathering of people in church, theatre, schoolroom and factory, the National Fresh Air for All Association has been incorporated in Illinois. Moving picture shows, some of which have failed to comply with the mandates of the Chicago Health Department, will be the first to be investigated by the new association. Some of the charter members are Mrs. Ella Flagg Young, Dr. Emil G. Hirsch and Miss Jane Addams. Headquarters of the new association have been established at the Hotel La Salle, Chicago, and Miss Kate F. O'Connor has been appointed secretary.

The association's first manifesto, which has been issued by Miss O'Connor, says:

"Now that it is an established scientific fact that fresh air is a healing force and foul air a deadly poison, and that fresh air will decrease the death rate, what more does one need as an incentive to spread the gospel of fresh air for all everywhere and all the time? To educate the people is to prove that the human race cannot grow strong and be content and cheerful without fresh air. This can be done by creating public sentiment, which is stronger than any law."

American Society for Fire Prevention.

At a meeting held in New York Feburary 11, organization was completed of the American Society for Fire Prevention. Among the directors are Reginald Pelham Bolton, Charles G. Armstrong and Frederick A. Forgee, all of whom are members of the American Society of Heating and Ventilating Engineers. Arrangements have been made for the publication of a monthly magazine to be known as "Fire Protection." It will be the official organ of the society.

CORRESPONDENCE

Streptococci in New York Schoolroom Air.

Editor HEATING AND VENTILATING MAGAZINE:

Referring to my article on School Ventilation in New York Schools, (published in THE HEATING AND VENTILATING MAGAZINE for September, 1913), through an error in computation, the estimates of mouth streptococci in New York schoolroom air, cited in the article on Page 22, were based on the total volume of air filtered (868 cu. ft.), whereas only one-fifth of each cubic foot was actually examined for these organisms. Where it is stated that six streptococci were found per 100 cu. ft. of air the figure, therefore, should be thirty, instead of six. The average numbers for the individual schools range, for the most part, between 10 to 35 per 100 cu. ft. In the crowded school in a poor district, the number was 75 and in the school in the good, semi-suburban district no streptococci were found in 8 cu. ft. The ratio of mouth streptococci to total bacteria should be 1:320, instead of 1:1,600.

The numbers are, in any case, so small that I see no reason to modify the general conclusion drawn from the incorrect figures given in the text.

C.-E. A. WINSLOW.

New York, February, 1914.

Elimination of Dust in Heating Systems.

Editor HEATING AND VENTILATING MAGAZINE:

In connection with the accumulation of dust on radiators, especially in indirect steam heating systems or where hot air furnaces are used, both in large or small buildings, I would offer a suggestion to prevent most of this dust which enters from the outside, from passing into the room. The method I have in mind is to place curved plates in the nature of baffle plates in the cold air box between the point where the cold air enters and the furnace or radiators. Directly beneath the baffle plates slides or doors could be located, for cleaning the box of the accumulated dust. I offer this suggestion for what it is worth.

New York, January, 1914. J. R. S.

Remedying a Poorly-Designed Heating System.

Editor HEATING AND VENTILATING MAGAZINE:

I have been following with interest the questions and answers contained in your "Consulting Engineering" Department. It contains some very valuable suggestions for overcoming the knotty problems that a steam fitter runs up against in his work.

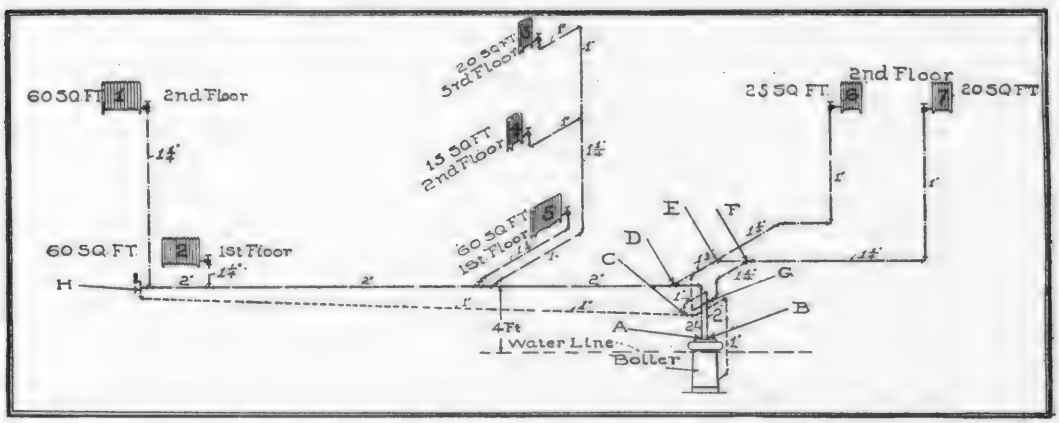
Regarding Question and Answer No. 24 (published in your January issue) on remedying a poorly-designed house heating system, I think you hit the nail on the head with one exception and that is when you recommend making the 1-in. steam connection to the return line at C. To my mind, this spoils the whole thing. This connection, as you say, will relieve the difference in pressure between the boiler and the return main, thus preventing the water from leaving the boiler; but now the trouble begins. This steam will rush up the return main toward the point H against the flow of condensation which is continually flowing as long as the radiators are heating, thus retarding the flow of the water, causing surging and water hammer. Also, when the steam finally does get to H, two streams of steam will come together from opposite directions, which is sure to cause severe water hammer at this point.

To my mind, the new connections to Radiators Nos. 3, 4, 6 and 7 will remedy the trouble of the water disappearing in the glass. The disappearing of the water, as you say, is due to the excessive difference in pressure between the boiler and the return main. This difference in pressure is due to excessive friction in the steam main which, in turn, is due to the

excessively high velocity of the steam in the main. These new connections will relieve the excessive demand for steam through reducing the velocity which, in turn, will reduce the drop in pressure and entirely do away with the necessity of the connection at C.

From the sketch it looks as though you have a cross at the point G, so that the condensation from Radiators Nos. 6 and 7 will come together "head on" from opposite directions. This will also cause water hammer. I would suggest that the connection at C be omitted and the connection to Radiator No. 6 be taken off just before the return pipe, the end being sealed. When the check draft opened, the steam condensed and water hammer followed.

If connection C was made and the check draft in the flue opened, the pressure would equalize through the main and return, and the water would seek that of the boiler water line. The pipes would then be empty. When the check draft closed and steam commenced to make, true it would pass up both the supply and return main, but the returning water would be of nearly the same temperature, so there would be no water hammer. Now, if there was any water at all held in the return main, with-



REMEDYING A NOISY HEATING SYSTEM.

getting to the elbow F and continue the 2-in. to this point. READER.

Los Angeles, Cal., February, 1914.

REPLY BY "CONSULTING ENGINEER."

Regarding the equalizing pipe connection, if there is a solid slug of cold water in the main, there will be water hammer, no matter where it comes from, due to the sudden condensation of the steam. If the condensation is within a few degrees of the temperature of the steam, there will be a surging, but no water hammer. A steam apparatus should be looked upon as a vessel containing a liquid and a gas, and any method of equalizing the pressure of the gas either side of the liquid will cause it to flow to the lowest point. Any difference in pressure either side of the liquid will cause it to stand still or flow in the direction of the least pressure.

In the original question, the condition of the water flowing out of the boiler occurred when the check draft closed and the steam condensed in the radiators, forming a vacuum which held the water in out connection C, so as to cause surging or water hammer, the circulation would be faulty. As a matter of fact, there is seldom any solid water in a horizontal dry return pipe on a heating system. It is usually steam of low quality, the moisture being mainly in suspension. The connection C, in case there is a tendency to be too great a difference in pressure, will tend to equalize the steam pressure either side so that it will flow out. If the supply pipe were of sufficient size the equalizing connection would not be needed.

The water hammer comes from the residual water due to the radiator forming a partial vacuum when the steam pressure goes down. With connection C, the water will not exist. As far as connecting Radiators 6 and 7 into the 2-in. pipe on the same level is concerned, it might be better to use two tees instead of a cross. To connect Radiator 6 at point F would not be nearly so good. It will be borne in mind that when radiators are connected to a riser, with a single pipe it is always better to drop each supply through the floor so as to get an independent drop. This is true in this case, with the risers as shown.

Testing Laboratory for Monash Specialties.

A view in the testing laboratory of the Monash-Younker Co., manufacturer of vacuum, vapor and gravity steam heating equipment, established a short time ago at 1407 West Jackson Boulevard, Chicago, Ill., is reproduced in the accompanying illustration. The room is situated in the basement of the building and is about 30 ft. square. It is of brick construction, lined with galvanized sheet iron. The floor is protected by a raised wooden floor and all wastes are drained into the sewer direct.

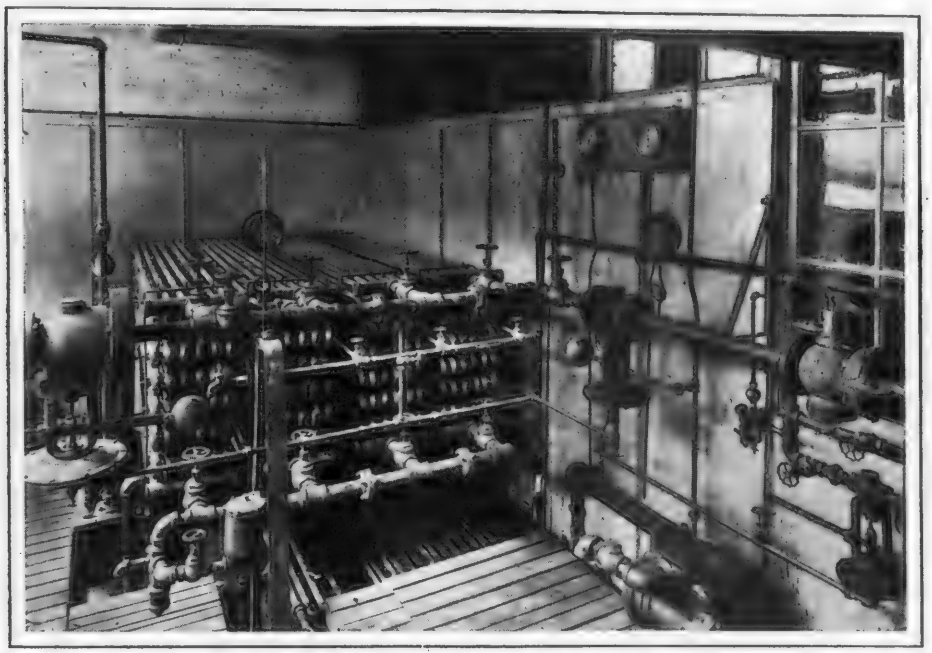
The equipment comprises a number of condensing units equipped with different regulating and measuring devices and appliances. The principal condensing apparatus consists of four box coils. Each coil is a separate unit and may be adjusted for creating various working conditions for determining the adaptability and the testing of the numerous heating devices manufactured by the company. By making such tests the company is able to accumulate extensive data pertaining to the capabilities of its products.

The source of steam supply is through two separate lines, one from the right and one from the left. Monash pressure regulating valves are installed to control the degree of temperature as desired. The illustration shows the high pressure piston regulator and the low pressure diaphragm regulator installed on the apparatus.

Besides the four coil units, a unit of 100 sq. ft. of cast-iron radiation is connected on a separate line which is also fitted with regulating devices for the purpose of testing smaller appliances.

The installation is equipped with a vacuum pump, capable of handling 10,000 sq. ft. of radiation. This pump is controlled with a Monash vacuum pump governor and can be adjusted to control any predetermined vacuum conditions and can also be readily attached to the separate units or cross-connected to the whole plant.

With the entire device equipped with gauges, properly calibrated thermometers, reservoirs, etc., unusual opportunities are at hand for conducting a wide range of experiments in this line of work.



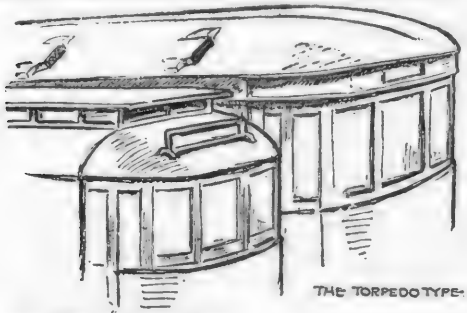
TESTING LABORATORY FOR MONASH SPECIALTIES.

New Public Service Act in Pennsylvania.

The public service company act, which was passed by the last legislature, became effective January 1. The membership of the commission consists of seven men who were apointed by Gov. Tener some time ago, but who have withheld all decisions on important matters covered by the act until it became fully operative. The act applies to almost all corporations engaged in public business, including central station heating concerns. The law does not apply to a producer of electricity, gas, power, steam heat or water for his sole use or for the use of his tenants.

Ventilating Arrangements for New Type of Street Car.

The accompanying illustration shows the new type of "torpedo" street car which is now in use in Kansas City. The "sealed" car, as it is also known, has ten ventilators in the top which, however, must be opened



NEW AND OLD TYPES OF STREET CARS.

and closed by the conductor depending on the direction in which the car is going. A feature of the new construction is said to be the cleanliness of the cars, as compared with the old types.

NEW DEVICES

Bristol's Pneumatic Type Recording Tachometer.

The field of usefulness of recording tachometers is a wide one because there is a great need for measuring and controlling the revolutions of shafting, machinery, engines, etc. For instance, blast furnace blowing engines are driven at a certain predetermined r. p. m. but are usually slowed up once every four hours at casting time.

Bristol's pneumatic type recording tachometer has been developed to meet such requirements. One of its special features is the flexible connecting tube, 25 ft. long, or longer, between the revolving mechanism and recording instrument which is mounted in any convenient position as, for instance, on a switchboard or the wall of an engine room. The patent on this pneumatic recording tachometer was issued on July 30, 1913, to Prof. Wm. H. Bristol.

The pneumatic principle of operation depends on the centrifugal action of air in a revolving tube which is connected on the recorder through a special oil seal and flexible connecting tube.

Fig. 2 shows diagrammatically the con-

FIG. 1. BRISTOL'S PNEUMATIC TYPE RECORDING TACHOMETER.

struction of the revolving mechanism. In the diagram, "B" is a hollow circular protecting base. At its upper surface it is provided with a bearing for a hollow shaft "D." This shaft is arranged to be rotated from any desired mechanism through a set of gears and pulleys (or sprockets).

A pulley, "C," is shown over which a belt runs to a similar pulley attached to the shaft whose revolutions are to be measured and recorded. In practice most of these tachometers are being furnished with special form of sprocket and chain instead of pulley and belts.

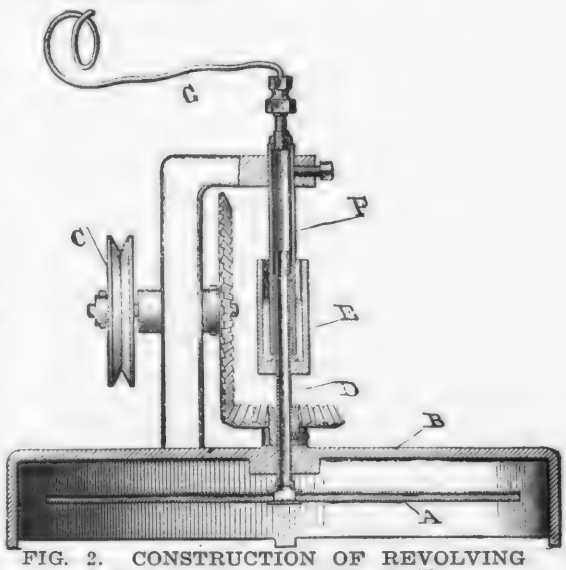


FIG. 2. CONSTRUCTION OF REVOLVING MECHANISM OF BRISTOL'S TACHOMETER.

The lower end of the hollow shaft, "D," terminates in a horizontal tube, "A," open at its extremities. The upper end of the hollow shaft is surrounded by a casing, "E." It is partly filled with oil and into this extends the free end of another tube, "F." The tube, "F," is stationary and is joined at its outer end to a flexible capillary connecting tube, "G," leading to the recording instrument. The recorder used with this patented speed measuring device is a special low range Bristol recording vacuum gauge.

These tachometers are manufactured by the Bristol Co., Waterbury, Conn., which also manufactures electrical tachometers.

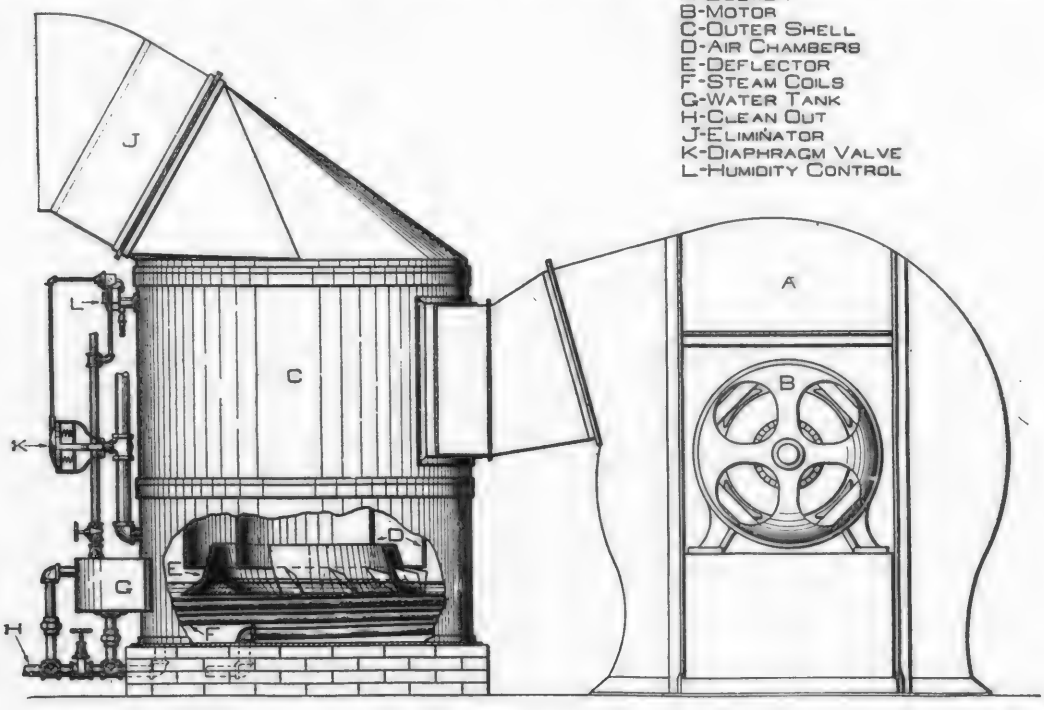
The Greeff Air Washer.

An interesting type of air washer, which was that used in the cooling, air washing and dehumidifying plant installed at the Mt. Sinai Hospital, New York (described in a paper on the subject published in the February, 1914, issue), is shown in the accompanying illustration. It consists primarily of three units, a motor-driven blower, a cooler and dehumidifier and a reheater. The blower is of the Sirocco type, and the fan is mounted on the same shaft with the motor armature. The capacity of the equipment installed at Mt. Sinai Hospital, operating at 1,200 R.P.M., is approximately 400 cu. ft. of air per minute.

The air is forced into the air washer through the air chamber which is shaped to conform with the elbow, as shown in the illustration. It then impinges on a conical deflector on which are mounted several projections shaped in the form of propeller blades. This propeller is stationary and the air is, therefore, given a rapid circular motion. The point at which the air strikes the deflector is on the surface of the water in the body of the machine. The motion thus imparted to the air creates a fine spray or mist, which is carried up through the main shell and through the cooling coils in the upper part of the apparatus. From this point the air passes through the eliminators which are designed to remove all free moisture, these eliminators returning the water back to the machine.

A cooling coil, consisting of iron pipes galvanized, is located below the water. There is also series of coils in the upper part of the machine around which the air and water spray pass, as previously mentioned. In this particular installation, a constant supply of cold brine is kept circulating through these pipes by means of a small motor-driven rotary pump. This brine is taken from the main refrigerating system in the hospital and returned thereto after passing through the coils.

To maintain a constant water level in the machine there is a small float chamber



GREEFF (BENTZ) AIR WASHER AND HUMIDIFIER CONNECTED TO BLOWER.

attached thereto on the outside. This chamber is provided with an overflow, through which the excess water, which is extracted from the air, passes out. The float valve, which automatically refills the machine after it has been drained, brings it up to the required level.

The air in passing through the equipment as described is cooled down below its dew point, thus precipitating a certain amount of moisture contained in it, so that when it leaves the eliminators it carries with it a fewer number of grains of moisture per cubic foot, although it is at a higher relative humidity. This is practically evidenced by the constant outpour of water through the overflow, which is solely the water extracted from the air.

After the air has passed through the eliminators it is usually carried through the reheater. In this installation this reheater was not in use during the past summer, as it was found that the radiation into the distributing duct from the surrounding atmosphere and also the rising temperature of this air as it entered the room was found to be sufficient to maintain a reasonably low relative humidity. The distributing ducts and registers in the room are of the same form as used for indirect heating, although for this kind of work, the writer believes, the cooled air should be introduced 7 or 8 ft. from the floor and allowed to find its way to the lower level, which it will naturally do, owing to its low temperature. Any air outlet which is provided in the room should be preferably near the top so that only the warmer air will escape.

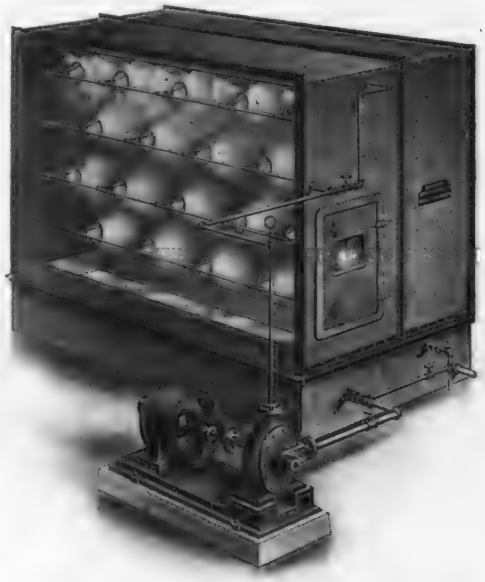
The Greeff air washer is made by the Greeff Engineering & Mfg. Co., Newark, N. J.

New Type of Air Washer

An interesting type of air washer, which is notable especially for its spray nozzle and the construction of its eliminator plates, has been placed on the market by the Spray Engineering Co., 201 Devonshire St., Boston, Mass. It is known as the Spray Engineering Company's Air Washer. In appearance the lines of this new device follow those of the standard type of air washer. Its interior construction, however, reveals many unique features.

The nozzle is especially noteworthy. Instead of forming a thin, hollow cone of spray, the Spray nozzle is designed to fill the chamber with a dense and fine mist, making it impossible for the air to get through the washer without passing through a large volume of spray. The nozzle is composed of three parts, one of which is a removable turbine center having large passageways. This center is held stationary in the nozzle so that there are no moving parts to wear out. The water in passing through, is given a rapid rotating motion. A central driving jet impinging on the rotating water at the orifice ejects it as a fine, dense and uniform spray. Attention is also called by the manufacturers to the fact that they are operated at a lower pressure than is usually necessary.

The density of the spray as it leaves the nozzle is made still finer by passing it through a screen with a fine wire mesh. In addition, auxiliary sprays are provided which operate to throw water downward



SPRAY ENGINEERING COMPANY'S AIR WASHER.

from the top of the spray chamber, assisting in throwing down a large portion of the dirt and free moisture before it reaches the eliminator.

The eliminator plates of this air washer consist of a fine-mesh screen. By this means, it is stated, it is impossible for the air passing through the eliminator to carry with it free moisture in suspension. The water is sprayed in the same direction as that of the air flow. A small centrifugal pump serves to pump the water supply from the bottom of the washer into the distributing lines.

The company's air washer is described in detail in a catalogue issued as Bulletin No. 52, although we are advised that the company has in preparation a new catalogue which will cover the features of this air washer even more thoroughly.

NEW BOOKS.

HEATING SYSTEMS, AND THE DESIGN OF HOT WATER AND STEAM HEATING APPARATUS, by F. W. Raynes, consulting heating and ventilating engineer and lecturer on heating and ventilation at the Royal Technical College, Glasgow, Scotland, is the title of a new work recently brought out by Longmans, Green & Co., London and New York.

This book, in its general arrangement, will be found an excellent one for student use. The chapters describing the different methods of heating and those on vacuum steam heating are especially satisfactory in showing the limitations in the use of such systems. The illustrations are clear and original in style of presentation, notably those giving piping methods.

However, outside of the descriptive matter on steam and the arrangement of the subjects treated, there is little matter presented that may be said to be new. One of the practices mentioned by the author concerning the principle of flow through a series of radiators, in which he recommends that the fluid have the same direction of flow in both supply and return pipes, as against the usual practice of reversing this operation, was discussed, for instance, in the consulting engineer department of THE HEATING AND VENTILATING MAGAUINE.

Several well-known formulas are used without explanation of their origin and with constants supplied by the author. In the case of the hydraulic formula for the discharge of water for hot water heating, the same coefficient is applied for each size pipe, both for gravity and for forced circulation at all velocities. These coefficients should be different for each velocity as well as diameter of pipe to obtain proper results. It would seem that either a formula should be given and employing fractional exponents or the different constants for all velocities should be included. This makes a considerable percentage of error in the author's results.

The formula and constants for the flow of steam seem to be fairly correct except for the small scale of abscissae used in the charts, one division being equal to 60 H. P., in one case.

The chapter on forced hot water heating, if applied to plants, except where the heating needs are in excess of the available supply of exhaust steam, would result in uneconomical operation. Some of the data, especially in connection with high building heating and operation of hot water heating systems under partial vacuum, are similar to those presented to the American public under the title of "Vacuo Hot Water Heating," but with the notable difference that engines are run noncondensing which, as stated, would prevent economical operation.

The method cited of submerging the tubes of an exhaust heater to vary the output by covering the heating surface with the condensate is hardly practicable and would cause trouble in the case of a turbine.

Capt. Reck's system for using high temperatures and great drops in temperature on the main, with a bypass to mingle with the hot water in the risers at a lower temperature and velocity, would lead to much complication and adjustment on a large hot water plant and it should also be borne in mind that the high temperatures would preclude the use of exhaust steam as the heating medium. This arrangement is ostensibly to reduce the pumpage on a hot water plant. As live steam only could be used on such a plant, requiring high temperatures, the pumpage would cost nothing if the exhaust were utilized with lower temperatures and higher velocities. Where this could not be accomplished, steam at a corresponding pressure could be used with greater economy directly in the system. The pumpage on a hot water heating system utilizing exhaust steam costs no more and possibly less than the power required to produce a vacuum and remove the condensation from a vacuum steam system.

In describing the shunt arrangement of branches in forced hot water heating, the author states that the flow in the main and branch within the shunt will be inversely as the resistance. The resistance is the loss in head between the two points of joining of the shunt and main. This loss in head will be the same for both and if the author's statement were correct, the flow would be the same, which, as he states, is not the case.

The flow in either will vary as the diameter, length and velocity of shunt and main, and when the factors equalizing the head are equated the loss in head is estimated from the equation. With part of the quantities known and the total water flowing in a unit of time outside the shunt the unknown quantities can be found by solving the two equations, or the relative velocities in terms of one equation. Size 6x9 in. Pp. 328, with illustrations, together with 32 tables and 29 charts. Price $3.50 net.

Pennsylvania Master Steam Fitters to Push Enforcement of Separate Contract Law.

Co-operation on the part of the various organizations interested in the enforcement of the new Pennsylvania law providing for separate bids on plumbing, heating, ventilating and electrical work on public buildings has been secured through the appointment of a joint conference committee. The associations which have delegate representation include the Pennsylvania Master Steam and Hot Water Fitters'

Association, the Pennsylvania State Association of Master Plumbers, the Electrical Contractors' Association of Pennsylvania and the Philadelphia Sheet Metal Contractors' Association.

At the organization of the joint conference committee, William P. Thompson, who is president of the Pennsylvania Master Steam Fitters' Association, was elected chairman, and M. G. Sellers, secretary of the Pennsylvania Master Steam Fitters' Association, was elected secretary. The treasurer is H. G. Kepler. Necessary counsel will be engaged for legal advice and counsel.

In a notice sent out by the State association of master steam fitters, a number of court decisions under the new act are cited which show the effectiveness of the new law. The circular states that a recent canvass of the State would seem to indicate that the law is being generally observed, but the members are urged to proceed on educational lines, having recourse to legal process only when absolutely necessary.

New Publications.

VACUUM CLEANING ENGINEERING, by E. J. Moore, is a handy treatise on this subject, designed especially for the use of architects. The various features are presented so that it will be easy for the reader to compare the various systems and thereby secure the necessary data for drawing specifications. One section is devoted to the requirements to be demanded. This is followed by a summary of the different types of devices. The reader is also given some hints on piping specifications, foundations and wiring. The treatise concludes with a typical specification complete. In an appendix the author makes a further comparison of different systems, in which he champions the use of high over low vacuum. Under this heading is discussed the care of hose, high vacuum—effect on rugs and carpets, practical use of vacuum cleaning in office buildings, portable vs. stationary vacuum plants and remote control systems. Size, 6 x 9 in. (standard). Pp. 34. Published by the Fuller Publishing Co., Seattle, Wash. Price, 50 cents.

NATIONAL DISTRICT HEATING ASSOCIATION has published in bound form the proceedings of its fifth annual convention in Indianapolis in 1913. The book is one of 224 pages and contains the papers and committee reports presented at that meeting, together with the discussions. The volume was prepared by D. L. Gaskill, secretary of the association, Greenville, O.

TRANSACTIONS OF THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS for 1912 has been published and makes one of the largest volumes ever issued by the society, there being over 500 reading pages. In addition to the papers, committee reports and discissions covering the annual and mid-summer meetings of that year, the volume contains the constitution and by-laws as revised two years ago.

HEATING AND VENTILATION, designated as Catalogue No. 215, and published by the B. F. Sturtevant Co., Hyde Park, Mass., is a publication of such scope as to merit distinction as one of the important trade publications of the year. The volume contains 334 pages and is divided into two parts, the first comprising text matter and the second part being devoted to tables of which there are no less than 42. The book is especially arranged so that both layman and engineer may readily find the matters that most interest them. For instance, the casual reader is spared a technical discussion of subjects in which he has little interest. If a layman he may read the first four chapters and chapters 8 and 9 with reference to the others if he so desires. On the other hand, if more technically inclined he will find himself supplies with information for reference. The book takes up theoretical considerations; ventilation; heat, heating and cooling; heating and ventilating calculations; testing; special problems of application and typical installations and tables. This is in addition to the portions dealing more particularly with the Sturtevant apparatus. Owing to the cost of publication, a nominal price is charged for the book. Size, 6¾x9¼. Pp. 335.

Trade Literature

PHENIX SIGHT FLOW INDICATOR, a bulletin recently issued by the Richardson-Phenix Co., Milwaukee, Wis., illustrates and describes how this unique little device can be inserted in any pipe line carrying a liquid, such as water lines of water-cooled transformers and the supply pipes of water jackets of gas engines and air compressors, and how it shows at a glance or indicates electrically by lighting a lamp or ringing a bell when the flow of the liquid is interrupted. Size 6x9 in. (standard). Punched for binding. Pp. 8.

PATTERSON HOT WATER SERVICE HEATERS, manufactured by Frank L. Patterson & Co., New York, is the title of a new catalogue describing this well known line of hot water service heaters and convertors. A welcome feature of the catalogue is the concise manner in which the heaters are presented, long descriptive matter in each case being carefully omitted. This greatly enhances the value of the catalogue for quick reference purposes, and with

tables of dimensions as given the desired units may be readily selected. The characteristic feature of the Patterson heaters, with the ∩ shaped seamless brass tube, are displayed in the illustrations, which include both photographic views and detailed drawings. Size 6x9 in. (standard). Pp. 24.

AUTOMATIC CUT-OFF VALVES are described in the latest bulletin to be issued by the Lagonda Mfg. Co., Springfield, O. This book takes up the causes and effects of water hammer in boilers, the effect of cutting in boilers below or above the pressure of the steam header, the specifications of boiler insurance companies and the methods of government tests, showing the application of the Lagonda automatic cut-off valves under such conditions.

LEATHER DRIERS, with particural reference to the Bossert tunnel drier and the Bayley hot and cold air drying system, are discussed in a catalogue issued by the Bayley Mfg. Co., Milwaukee, Wis. The booklet takes up the requirements for the drying of leather and shows in detail how this is accomplished by the Bossert tunnel drier, which has the appearance of a long, rectangular tunnel built up on steel frames. The drier is equipped with fan and steam pipes and also has chain conveyors for carrying the hides. Size 6x9 in. (standard). Pp. 12.

KROESCHELL COMBINATION WATER TUBE AND FIRE TUBE HIGH PRESSURE STEAM BOILER, patented in 1912 by Kroeschell Bros. Co., Chicago, Ill., described in newly issued circular matter, is an interesting type of return tubular boiler, to which are attached two headers or water legs with three or four water tubes, according to size. The construction of the front connection causes the water to flow with a high velocity over and under a flume placed near the bottom of the shell and extending about two-thirds the length of the boiler. This high velocity serves to prevent the deposit of scale forming material on the shell and tubes. Emphasis is laid on the rapid positive circulation, which, it is stated, gives the boiler an efficiency equal to any water-tube boiler and high overload capacity. The boiler is made in eleven regular sizes, having capacities ranging from 1,000 to 3,485 sq. ft.

FANS AND BLOWERS, including steel plate fans, cone fans and heaters, made by the Clarage Foundry & Mfg. Co., Kalamozoo, Mich., are the subject of a well-designed catalogue (Catalogue No. 3). In a foreword on "Efficiency and Steel Plate Fans" the manufacturers state that "in the blower business the multiblade fan has been featured with great talk of efficiency. Many of the arguments are good; many more of doubtful value. The older type of steel plate fan is still much favored for some kinds of work; in fact, the use of the multiblade type of fan is impossible in some installations. In other places, notably when the fan is driven by an engine and the exhaust steam used in the heater or elsewhere the point of efficiency is not well taken. In still other places the higher cost of the multiblade fan is sufficient to offset the slight saving in the cost of power." The statements quoted will be read with interest in connection with an address published on another page of this issue on the subject of fan selection. The catalogue lays special emphasis on the construction of the Clarage bearings, which are described in detail, as is the construction of the Clarage fan wheels. The catalogues include full tabular data of each type. Size 6x9 in. (standard). Pp. 32.

STURTEVANT STEAM TRAP, described as being constructed on a principle proven correct by many years of use under varying conditions, is the subject of circular matter being sent out by the manufacturer, the B. F. Sturtevant Co., Hyde Park. It is pointed out that the Sturtevant steam trap may be installed attached to radiators without excavating or large expense and requires no adjustment for varying pressures.

A TREATISE ON VACUUM CLEANING SYSTEMS, by A. A. Summerton, being a reprint of a series of articles on this subject, published in THE HEATING AND VENTILATING MAGAZINE for March, April and May, 1911, is the title of a booklet issued by the American Rotary Valve Co., Chicago, Ill. The topics discussed include dust separation, disposal of collected dust, types of exhauster, volume of air and amount of vacuum, piping, automatic unloaded, scrubbing and disinfecting, appliances, testing, and specifications for installations. Size, 3¼x6¼ in. Pp. 49.

BOYLSTON STEAM SPECIALTIES, devoted to the regulating and other devices made by the Boylston Steam Specialty Co., Chicago, Ill., is the title of a new catalogue (No. 12), which deals exhaustively with the company's product. Attention is called to the fact that the devices are the outcome of nearly thirty years experience in the manufacture of this line. One of the interesting features of the catalogue is a drawing showing a power house heating and ventilating arrangement with the Boylston specialties in position. This is followed by detailed descriptive matter, accompanied by illustrations, of the Boylston pressure regulating valves of various types, reducing valves, back pressure valves, pop safety and water relief valves, return steam traps and boiler heaters, and the Boylston improved steam trap. Broken views of the latter device show how this trap operates. Some of the other specialties presented are low pressure grease traps, water line trap or governor, positive acting condensation receiver and automatic pump

regulator, condensation or receiving tank controllers, and a line of vacuum steam heating specialties. Size, 6x9 (Standard). Pp. 96.

HALSEY MANUFACTURING CO., Philadelphia, Pa., announce in newly-issued circulars a short-time introductory offer of the Halsey everlasting self adjusting thermo valves and traps which will be sold at cost for the first installation only in each city. The company's line includes air line valves, vacuum generating valves, insertable disc traps and thermo return valves.

STANDARD REINFORCED SPIRAL PIPE, including also forged steel flanges, valves, cast fittings and specialties, are the subject of a new catalogue just published by the Standard Spiral Pipe Works, Chicago, Ill. The advantages of this form of piping are given in detail and list prices are included covering the company's product. Size(4¼ by 9 in. Pp. 36.

DOODY VAPOR HEATING SYSTEM, which is manufactured and sold by the Doody Vapor Heating Company, Boston, Mass., and which has now been on the market for five years, is presented in new catalogues explaining the construction of the devices and giving a list, with photographs, of some of the more important installations. This system, it is stated, is suited to all varieties of buildings and its advantage are given as:

1. Perfect automatic regulation at the boiler combined with independent regulation at the radiator.

2. Great economy in coal consumption by reason of this regulation, together with even heat 24 hours of the day with the least attention at the boiler.

3. The eliminaion of the disagreeable features of steam and hot water systems in the form of leaks, freezing, noises caused by water hammer, etc., through the absence of pressure.

Both steam and hot water heating systems, it is stated, can readily be converted to the Doody system. The principal attachments consist of a vapor vent, a vapor valve, and a special device known as the Doody vapor heating attachment, which is attached to the boiler.

TUEC STATIONARY CLEANERS, made by The United Electric Company, Canton, O., are discussed in a handsomely designed new catalogue showing, among other things, an impressive array of buildings equipped with the Tuec cleaning system.

Diagrams are included illustrating the comparative sizes of the Tuec rug cleaning tool and others. The company's plant is reproduced and is characterized as the largest exclusive stationary cleaner factory in the world. Size 9x11 in. Pp. 36.

DAVIS IMPROVED FLOAT VALVE, described as the simplest and most desirable way to maintain a constant water level in a tank or reservoir is the subject of a circular issued by the G. M. Davis Regulator Co., Chicago, manufacturers of this device. If the water is supplied by a pump, a float valve serves the double purpose of automatically maintaining a constant water level and of stopping the pump when no more water is required by closing and building up the pressure in the line between the valve and the pump until it is sufficient to balance the pressure on the steam cylinder. The requirements of an ideal float valve are given as: it should be tight when closed, should operate without friction, should not leak at the stem, should have renewable seat and disc and should be well proportioned and strong. In the Davis type, the inner valve or disc is semi-balanced, has a hollow post and is operated entirely by pressure. The stem, which is connected to the float by means of a lever, forms an auxiliary valve that seats in the top of the hollow post of the disc. The pressure at the valve must be great enough to lift the actual weight of the disc. About 3 lbs. is required for valves less than 6 in. in size, and about 5 lbs. for the larger sizes. When this pressure is not available a valve can be furnished with a balanced disc that does not require any pressure to operate it. The top member of the disc is fitted loosely in the cylinder, which is part of the cover, so the inlet pressure may leak by and accumulate in the chamber above the valve where it is increased or decreased by means of the auxiliary valve which closesw hen the float is raised by the water level and opens when the level recedes. This valve, when equipped with a straight lever, may be used in many places where a balanced valve with piston disc is used and has the advantage of being tight when closed. As a water inlet valve for feed water heaters, it is desirable because it has a positive seat with renewable disc, is practically frictionless, can be operated by a small float, and is installed with the cover above the pipe line instead of upside down, as most balanced valves have to be used. It is made in fourteen sizes, ranging from ¾-in. up to 12-in.

J.-M. ASBESTOS, MAGNESIA AND ELECTRICAL PRODUCTS, made by the H. W. Johns-Manville Co., New York, is the title of a new publication made necessary by this concern's extensive line, giving under appropriate headings a full list of the materials it manufactures. These are grouped under such headings as roofing and building materials, non-conducting coverings, steam packings, etc.; vulcabeston, fireproof cements, etc.; asbestos fabrics and specialties, asbestos household articles, electrical supplies, cold storage insulation and J-M specialties. No less than 158 different articles are listed.

National Warm Air Heating and Ventilating Association.

Final organization of the National Warm Air Heating and Ventilating Association, the new body formed to further the interests of the furnace heating industry, was effected at Detroit, Mich., February 6, when the executive committee met to outline the plans and methods to be followed.

The president of the association is John D. Green, of the Detroit Stove Works, Detroit, Mich. Mr. Green has long been active in the National Association of Stove Manufacturers and was also one of the workers in the Federal Furnace League, which is now succeeded by the new organization.

Those present at the meeting, including the officers and all of the members of the executive committee, were: Vice-President F. T. Giblin, Treasurer W. G. Wise, Acting Secretary William F. Colbert, E. P. Miller, John A. Howard and Charles F. Seelbach. Others present were Allen W. Williams, secretary of the Midland Club, and D. Rait Richardson. The object of the association is "to promote the proper installation of warm air heating systems through systematic education in every department of the industry."

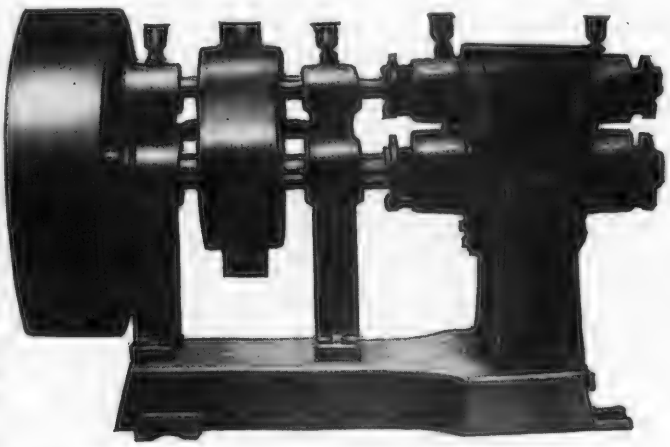
One committee appointed at the meeting will consider the development of a formula for warm air installations, embracing such items as heating requirements, piping, cold air supply. This committee is composed of D. Rait Richardson, Richardson & Boynton Co.; E. P. Miller, Lennox Furnace Co., and Arthur R. Bradley, Kelsey Heating Co. Other committees will take up the matter of dealers' costs, co-operation with architects, instructions to dealers for properly presenting the merits of warm air furnace heating, an advertising campaign, selling instructions for manufacturers, the development of a manufacturers' cost formula, a credit bureau and a salemen's bureau.

Since the meeting, Allen W. Williams, Brunson Building, Columbus, O., has been appointed secretary of the association.

The Beach-Russ Vacuum Pumps.

The demand reported by the Beach-Russ Company, 220 Broadway, New York, for its return line and air line rotary vacuum heating pumps, which has resulted in this department of the company being rushed with orders, calls renewed attention to their features of construction. The company's return line pumps, which are used for removing water and air from radiators, at the same time maintaining a partial vacuum in the heating system, are notable in that they have but two movable parts, and as they are not in contact, there is no wear from friction. They also possess the advantage of requiring less power and floor space than would be otherwise required.

The company's air line vacuum pump is distinguished from the return line unit in that whereas the return line pump forces the condensation back to the boiler, the air line pump handles only the air which accumulates in the radiators and piping.



BEACH-RUSS RETURN LINE ROTARY VACUUM HEATING PUMP.

With the air line type the condensation returns to the boiler by gravity and the air is drawn into a receiving tank.

The air line pump is equipped with an electric automatic starting and stopping device, with vacuum regulator, so that 5 in. to 6 in. of vacuum, or more if necessary, is always maintained on the heating system. As soon as the vacuum drops the pump starts automatically and forces the vacuum to, say 6 in., when the automatic electric switch stops the pump. It does not start again until there is more air to be removed from the radiators. The Beach-Russ Co., whose full line includes vacuum pumps, pressure blowers, liquid and water pumps, state that its latest styles of vacuum heating pumps, here described, have found the most favor of any of its products.

VAN AUKEN SYSTEM OF VACUUM HEATING is featured in new circular matter published by the Thermograde Valve Company, Boston, Mass.

Modern Vacuum Cleaning Apparatus

16—The Hydro Stationary Vacuum Cleaner.

Under the title of "Nothing Moves but the Dirt," the Hydraulic Vacuum Cleaning Company of Pittsburg, Pa., is issuing an attractive booklet calling attention to the Hydro stationary vacuum cleaning system.

The Hydro system is unique among vacuum cleaners in the fact that there is not a single moving part—no motor, fan, pump, etc. The Hydro embodies another feature in the disposal of the debris from the suction line. This debris is drawn directly into the sewer, thus obviating any necessity of dust bins, etc. This eliminates all labor connected with the removal of the dirt from the unsanitary dust-receptacle.

Being without a single moving part, the Hydro is said to be "fool-proof." The manufacturers state that, during the floods which swept over part of the country last spring, a Hydro system, which had been installed in a residence, was completely submerged for several days without injury.

In Fig. 1 is shown the suction generator of the Hydro, which is protected by U. S. and foreign patents; disconnected from the water pipe (A); the sewer connection (B); and the riser pipe (C). This is installed in the basement of the building, with riser pipe (C) running to the different floors. The space required for the generator is 7½ x 20 in.

By referring to Fig. 1, the working principle of the Hydro system is seen. Waten enters at (A) and drops vertically through the discharge pipe to the sewer. The action of the water in passing through the nozzle ⅛ in. opening, using about one-tenth the quantity of water of the ordinary kitchen faucet under pressure induces a high vacuum in vacuum cushion chamber. Under careful test a vacuum of 26 in. will be shown. The column of water falls in a straight line into the discharge pipe, and breaking into spray, maintains a constant vacuum of 3 to 5 in. mercury gauge, and displaces from 45 to 75 cu. ft. of air per minute. As shown by the arrows, the rarified air and dust are drawn into the discharge pipe; the dirt and dust being forced into the sewer by the action of the water, and the air escaping at the end of the discharge pipe.

A flusher is provided which is operated by moving a small lever. The flusher is a spoon-shaped device, and at the will of the operator can be moved directly beneath the stream of water, diverting it against the inside walls of the generator, thus removing any particles of dust or dirt which may adhere to the inner surfaces.

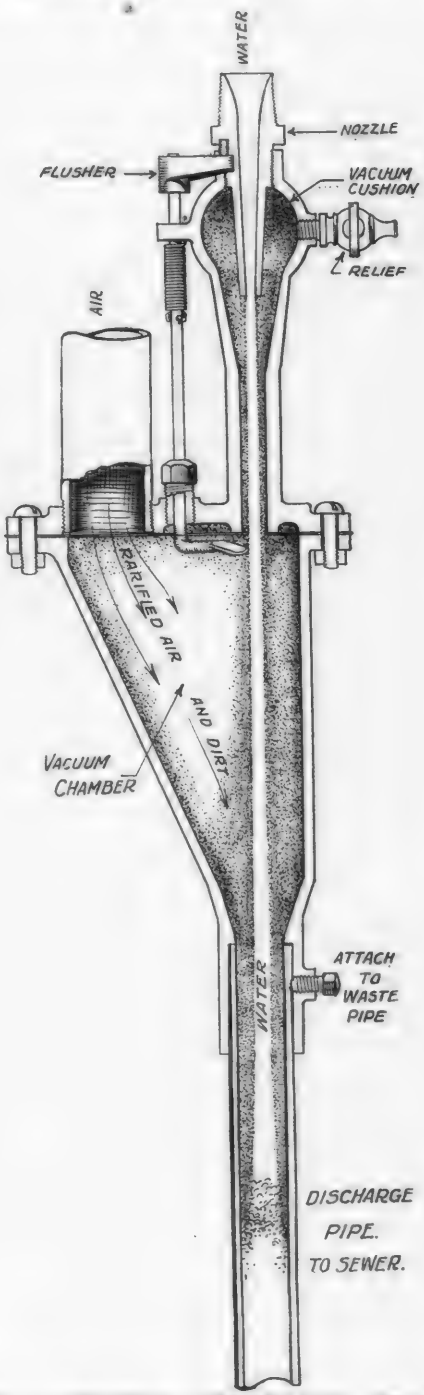


FIG. 1—SUCTION GENERATOR OF THE HYDRO STATIONARY VACUUM CLEANER.

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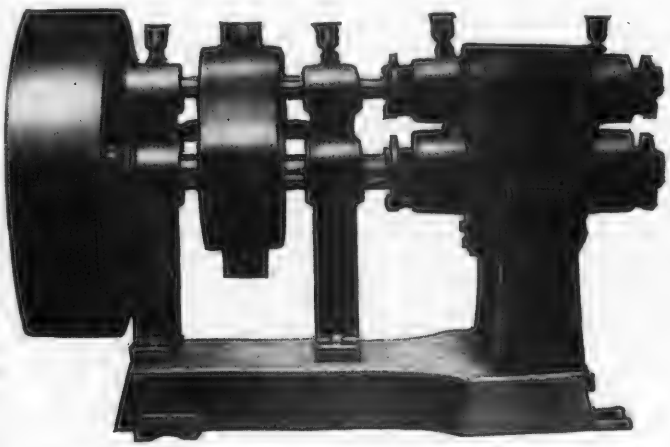
Since the meeting, Allen W. Williams, Brunson Building, Columbus, O., has been appointed secretary of the association.

The Beach-Russ Vacuum Pumps.

The demand reported by the Beach-Russ Company, 220 Broadway, New York, for its return line and air line rotary vacuum heating pumps, which has resulted in this department of the company being rushed with orders, calls renewed attention to their features of construction. The company's return line pumps, which are used for removing water and air from radiators, at the same time maintaining a partial vacuum in the heating system, are notable in that they have but two movable parts, and as they are not in contact, there is no wear from friction. They also possess the advantage of requiring less power and floor space than would be otherwise required.

The company's air line vacuum pump is distinguished from the return line unit in that whereas the return line pump forces the condensation back to the boiler, the air line pump handles only the air which accumulates in the radiators and piping.



BEACH-RUSS RETURN LINE ROTARY VACUUM HEATING PUMP.

With the air line type the condensation returns to the boiler by gravity and the air is drawn into a receiving tank.

The air line pump is equipped with an electric automatic starting and stopping device, with vacuum regulator, so that 5 in. to 6 in. of vacuum, or more if necessary, is always maintained on the heating system. As soon as the vacuum drops the pump starts automatically and forces the vacuum to, say 6 in., when the automatic electric switch stops the pump. It does not start again until there is more air to be removed from the radiators. The Beach-Russ Co., whose full line includes vacuum pumps, pressure blowers, liquid and water pumps, state that its latest styles of vacuum heating pumps, here described, have found the most favor of any of its products.

VAN AUKEN SYSTEM OF VACUUM HEATING is featured in new circular matter published by the Thermograde Valve Company, Boston, Mass.

Modern Vacuum Cleaning Apparatus

16—The Hydro Stationary Vacuum Cleaner.

Under the title of "Nothing Moves but the Dirt," the Hydraulic Vacuum Cleaning Company of Pittsburg, Pa., is issuing an attractive booklet calling attention to the Hydro stationary vacuum cleaning system.

The Hydro system is unique among vacuum cleaners in the fact that there is not a single moving part—no motor, fan, pump, etc. The Hydro embodies another feature in the disposal of the debris from the suction line. This debris is drawn directly into the sewer, thus obviating any necessity of dust bins, etc. This eliminates all labor connected with the removal of the dirt from the unsanitary dust-receptacle.

Being without a single moving part, the Hydro is said to be "fool-proof." The manufacturers state that, during the floods which swept over part of the country last spring, a Hydro system, which had been installed in a residence, was completely submerged for several days without injury.

In Fig. 1 is shown the suction generator of the Hydro, which is protected by U. S. and foreign patents; disconnected from the water pipe (A); the sewer connection (B); and the riser pipe (C). This is installed in the basement of the building, with riser pipe (C) running to the different floors. The space required for the generator is 7½ x 20 in.

By referring to Fig. 1, the working principle of the Hydro system is seen. Waten enters at (A) and drops vertically through the discharge pipe to the sewer. The action of the water in passing through the nozzle ⅛ in. opening, using about one-tenth the quantity of water of the ordinary kitchen faucet under pressure induces a high vacuum in vacuum cushion chamber. Under careful test a vacuum of 26 in. will be shown. The column of water falls in a straight line into the discharge pipe, and breaking into spray, maintains a constant vacuum of 3 to 5 in. mercury gauge, and displaces from 45 to 75 cu. ft. of air per minute. As shown by the arrows, the rarified air and dust are drawn into the discharge pipe; the dirt and dust being forced into the sewer by the action of the water, and the air escaping at the end of the discharge pipe.

A flusher is provided which is operated by moving a small lever. The flusher is a spoon-shaped device, and at the will of the operator can be moved directly beneath the stream of water, diverting it against the inside walls of the generator, thus removing any particles of dust or dirt which may adhere to the inner surfaces.

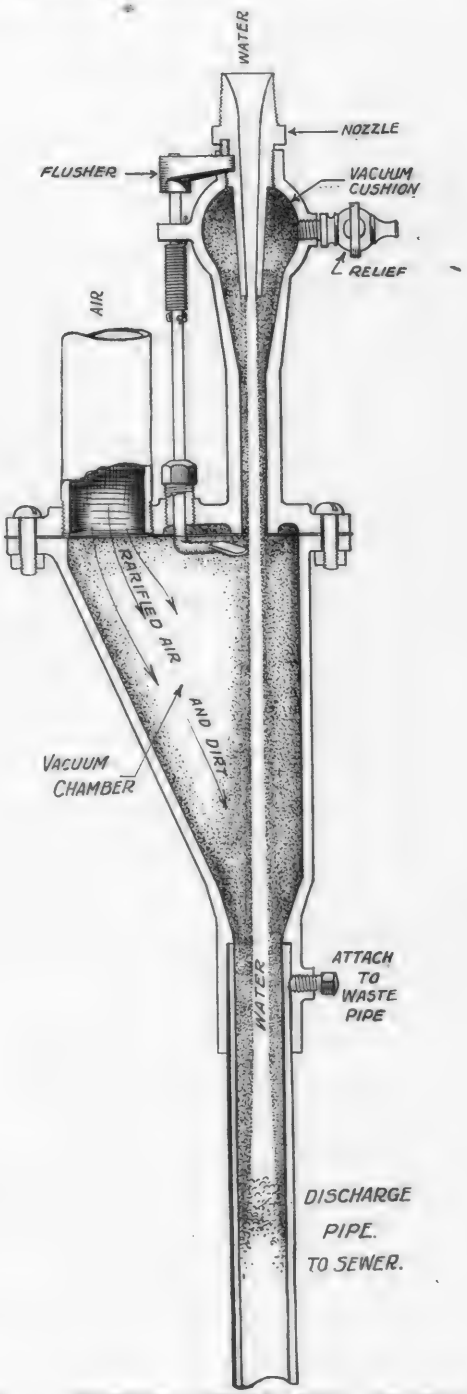


FIG. 1—SUCTION GENERATOR OF THE HYDRO STATIONARY VACUUM CLEANER.

Fig. 2 shows a diagram for installation of the Hydro in dwellings, etc. Owing to the simplicity of the piping arrangements, the cost of installation is low.

FIG. 2—DIAGRAM OF HYDRO INSTALLATION IN DWELLING.

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* Every other month.

TRADE AND MISCELLANEOUS NOTES

Coming Events.

Third Monday in Each Month.—Meeting of the New York Chapter, American Society of Heating and Ventilating Engineers, Engineering Societies Building, 29 West 39th Street, New York (evening). Subject for March meeting: "Schoolhouse Heating and Ventilation."

Second Monday in Each Month.—Meeting of the Illinois Chapter, American Society of Heating and Ventilating Engineers, in Chicago (evening). Subject for March meeting: "Hot Water vs. Modulated Steam for Residence Heating."

Second Tuesday in Each Month.—Meeting of the Massachusetts Chapter, American Society of Heating and Ventilating Engineers, in Boston (evening).

May 25-28, 1914.—Sixth annual convention of the National District Heating Association, Rochester, N. Y.

June 10-13, 1914.—Twenty-sixth annual convention of the National Association of Master Steam and Hot Water Fitters, Atlantic City, N. J.

June 16-19, 1914.—Spring meeting of the American Society of Mechanical Engineers, Minneapolis and St. Paul, Minn.

Deaths.

E. W. Blatchford, founder of the heating and plumbing supply house of E. W. Blatchford & Co., Chicago, died January 25, at his home in Chicago. He was 87 years old. Mr. Blatchford was for over 50 years a well-

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known figure in Chicago, being prominent not only in business circles, but in religious and philanthropic activities. He leaves a widow, two daughters and three sons, one of the latter being Paul Blatchford, secretary of the Central Supply Association.

..**Harry S. Maddock,** president of the Thomas Maddock & Sons Co., Trenton, N. J., died of pneumonia at his home in Trenton, January 24. He was 52 years old. He was the son of the late Thomas Maddock, a pioneer in the manufacture of pottery. He is survived by his son, Harold S. Maddock, his mother, two brothers and a sister.

Miscellaneous Notes.

Technical Publicity Association of New York, through a committe appointed to investigate and recommend standard sizes for catalogues, recently measured 927 different catalogues and found 147 different sizes, ranging from 3x5 in. to 11x14¼ in. As a result of the investigation the association now recommends that all material used by manufacturers be bound up either 6x9 in. or 8½x11 in.

London, Eng.—The College Board of the London Hospital has offered a prize of $600 for the best essay on "The Ventilation of Schools and Other Public Institutions."

American Society of Mechanical Engineers will hold its spring meeting in Minneapolis and St. Paul, June 16-19, 1914.

American Institute of Chemical Engineers will hold its sixth semi-annual meeting in Troy, N. Y., June 17-20, 1914.

Wallis & Goodwillie, New York, architects, announce the removal of their offices from 346 Fourth Avenue to 56 West 45th Street.

J. I. Lyle, of the Carrier Air Conditioning Company of America, New York, recently addressed the St. Louis branch of the American Society of Mechanical Engineers on "Air Conditioning." Mr. Lyle also visited the University of Michigan, where he addressed the students on the same subject.

National Pipe and Supplies Association will hold its next annual convention in New York, April 20-21, 1914. Headquarters will be at the Biltmore Hotel, near the Grand Central Station, and the sessions will be held in the Music Room on the second floor of the hotel.

Chicago Master Steam and Hot Water Fitters' Association, which recently absorbed the Chicago Heating and Ventilating Engineers' Association, as announced in the January issue, has also taken over the United Heating and Power Association of Chicago, the consolidation being effected at a banquet and business session, January 27, in the East Room of the Sherman Hotel. Among those who spoke were William Lees, president of the Master Steam Fitters' Association, who presided at the meeting; Frank Lamb, vice-president; William A. Pope, treasurer and Frank Douglas, secretary of the Master Fitters' organization; also John O'Shea, president of the United Heating and Power Association; Thomas Hanley, William Kroeschell and George Getschow. The total membership of the combined associations is 102.

Detroit, Mich.—A campaign to secure proper ventilation of Detroit's factories, schools, stores and office buildings is to be waged by the Detroit Society for the Prevention of Tuberculosis. An exhibtion of the newest appliances for proper ventilation will be arranged in a Woodward Avenue store as soon as the material can be collected. Mrs. Willard Pope will be in charge of the exhibition. Miss Clara Dyer is chairman of the ventilation committee.

Canton, O.—The action of L. P. D. Yost, school board member, in making a subcontract with F. E. Geisler & Co., of Pittsburg, for work on the Clarendon and Garfield School heating plants, has been held to be legal by Attorney-General Hogan, on the ground that there was no understanding between Yost and the contractors when the contract was let.

Chicago, Ill.—The progress of the health department in enforcing proper ventilation in theatres is reported in a recent bulletin of that body in which it is stated that on December 1, 1913, there were 409 unventilatel theatres and theatres partially ventilated but not complying with the ordinance. On January 31, the number had fallen to 393. On December 31 there were 175 theatres fully complying with the ordinance and on January 31 there were 202. In addition there are 16 new houses being built to comply and 43 old houses undergoing alterations to make them comply. In other words, there will shortly be 261 theatres fully complying, a gain of 60 in the past three months. Four have been closed by the department and 36 have closed voluntarily.

Birmingham, Ala.—Fire Chief A. V. Bennett will suggest to the commissioners the passage of an ordinance to regulate the size of warm air furnaces installed in residences of that city. Many of the recent fires, it is stated, have been due to the overheating of small furnaces during the

recent cold waves. City Attorney Romaine Boyd has stated that he believes an ordinance regulating the size of furnaces would be legal if it could be shown that they were proving a menace to property. Two of the heaviest residence fire losses were attributed to overheated furnaces, according to the fire department files.

Wichita, Kan.—An ordinance has passed its first reading in Wichita designed to insure better ventilation in churches and similar buildings.

Cincinnati, O.—Recent tests of the air in the moving picture theatres, which, as announced in the January issue, were being made by the Twentieth Century Club, of that city, showed in one case 14 parts of CO_2 in 10,000. In another theatre, 12 parts of CO_2 were indicated, while in a third theatre, the proportion was 11½ parts in 10,000. The best ventilated theatre had, according to the instruments, 9 parts of CO_2 in 10,000. The members of the club, which is a women's organization, were accompanied by City Chemist Clarence Bahlman.

Cleveland, O.—Cleveland's municipal steam heating plant on Fairmount Road, S. E., will soon be self-sustaining, according to official estimates. Receipts for January were $3,761, and it was figured that the income would be between $5,000 and $6,000 in February, as the number of consumers increased. In January the names of 131 consumers were on the books of the division. During January between $2,000 and $3,000 worth of coal was used for the heating service.

Coeur D'Alene, Idaho.—The new light and power rates, which were to be put into effect in Coeur D'Alene as soon as they were confirmed by the State Utilities Commission, involve a reduction of about 50% in cooking and heating rates. The new schedule offers current for domestic cooking and heating at 5 cents per kilowatt hour on the basis of using at least 25 kilowatts per month. The revised schedule has been confirmed by the city council, and the Kootenai Power Company has expressed its agreement to the schedule.

Gary, Ind.—Three Gary business men have petitioned the Board of Public Works of that city for a central steam heating franchise. A term of fifty years is asked, and if the city does not buy the plant at that time the grant must be extended an additional fifty years. If the franchise is passed a $200,000 corporation will be organized.

Manufacturers' Notes.

American Radiator Co., Chicago, Ill., declared a stock dividend February 3 of 10%, calling for the distribution of $744,150 in new common stock to the holders of the $7,441,150 of common now outstanding. The new stock dividend brings the outstanding common stock up to $8,185,650. The company has also declared the usual extra cash dividend of 2% and the regular

Jenkins Bros. Radiator Valves

excel because they are well designed, and made of a superior grade of new steam metal. The body, trimmings and all parts have strength and stability. They are made for satisfactory service, and guaranteed to give it.

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quarterly dividend of 2% on the common stock. The regular quarterly dividend of 1¾% was also declared.

Simonds Heating & Specialty Co., Grand Rapids, Mich., announces the resignation of Frank A. Simonds as president of the company.

B. F. Sturtevant Co., Hyde Park, Mass., reports the installation of two 16 ft. diameter fans, each 12 ft. wide, of the multivane type, in the Mullan Tunnel, near Helena, Mont., on the Northern Pacific Railroad. The fans have a capacity of 275,000 cu. ft. of air per minute and will change the air in the tunnel every two minutes.

H. B. Smith Co., Westfield, Mass., manufacturer of boilers and radiators, has purchased 10 acres of land on North Elm Street, Westfield, which will be used for future extensions of the company's plant.

Pierce, Butler & Pierce Mfg. Co., Syracuse, N. Y., whose affairs were recently placed in the hands of a receiver, announces that "we are obliged to report to you that on account of financial conditions the court has appointed A. W. Loasby, of Syracuse, N. Y., receiver for this company, and given him instructions to continue the business. These instructions of the court were very satisfactory to us, as it enables the business to be continued without any stop, pending a reorganization of our finances. Our factory is running and we have large stocks of goods there, as well as at our warehouses in New York, Boston and Philadelphia. We are in a position to take care of all orders you may favor us with promptly."

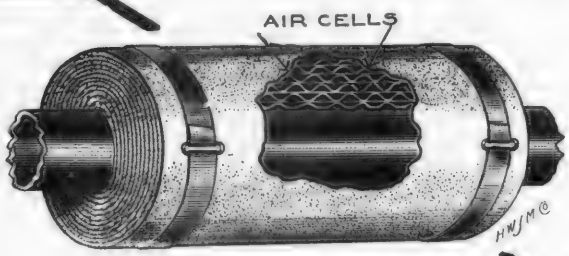
Marsh Valve Co., Dunkirk, N. Y., is making arrangements to establish a plant at Meadville, Pa., for the manufacture of its product.

William H. Page Boiler Co., Norwich, Conn., has increased its capital stock from $100,000 to $200,000.

L. O. Koven & Bro., New York, manufacturers of tanks for various purposes and other heating and plumbing supplies, have purchased a building on Jersey City Heights which will be converted into an office building for the use of the company.

American Blower Co., Detroit, Mich., held its 1914 sales convention in Detroit, January 28-30. It was attended by 50 of the company's sales and engineering representatives. The annual banquet was held at the Cadillac Hotel. Business sessions were held both at the hotel and at the

More Heat With Less Coal by Using JM Asbestocel Pipe Covering



Where hot water pipes and low and medium pressure steam pipes are in use, engineering tests and the experience of many users have proved that J-M Asbestocel Pipe Covering has not only conserved more heat and steam than was possible with any other pipe covering, but has saved hundreds of dollars in reduced coal bills.

"Dead Air" is the most efficient of all non-conductors or insulators. J-M Asbestocel Pipe Covering, with a large number of air cells running *around* the pipe instead of lengthwise, contains more "dead air" than any other pipe covering. Therefore, it is a perfect insulator, and reduces radiation and condensation of heat from pipes to a minimum.

J-M Asbestocel Pipe Covering is built on the arch principle, and this, in addition to the materials of which it is composed, makes this covering much stronger than others. It will last indefinitely, and in a few years will pay for itself several times over in increased heat and reduced fuel expense.

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1567

company's offices. A general expression based on views of those in attendance at the convention indicated more and better business for 1914 than was booked by the company during the previous year.

International Heater Co., Utica, N. Y., held the annual convention of its salesmen at Utica, February 3-5. Between 30 and 40 representatives were on hand. The sessions took up three days, and included talks on such subjects as "Boiler Ratings and the Selection of a Boiler," by Thomas J. Casserly. A dinner was held on the second evening of the convention at the Hotel Utica for the officials, salesmen, heads of the manufacturing departments and the members of the office force. President F. E. Wheeler was toastmaster.

Pratt & Cady Co., Hartford, Conn., whose affairs have been for two years in the hands of a receiver, it is announced, is now out of its difficulties and it is expected that the business will shortly be taken over by Bishop White, of West Hartford, and that Edwin Loomis King, the receiver, will remain with the company in another capacity. The success of Mr. King in bringing the concern out of its difficulties was made the occasion of a surprise dinner at the Hotel Bond, Hartford, February 14, when Mr. King was presented with a loving cup by the employees of the company. Many of the branch house managers were present.

New Incorporations.

Powell & Dorste, Anderson, Ind., capital $25,000, to deal in heating and electrical supplies. Directors: Walter H. Powell, Robert Dorste and Louis T. Dorste.

Standard Lighting & Heating Co., Louisville, Ky., capital $1,000. Incorporators: C. H. Franklin and George C. Devol.

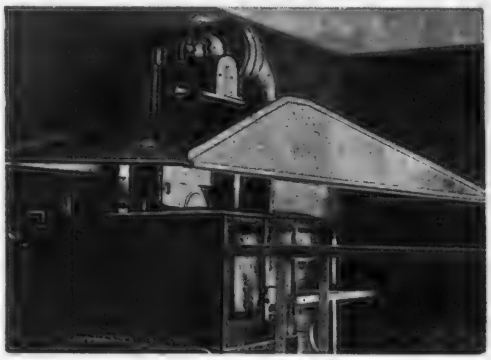
Berry Window Ventilator Sales Co., Augusta, Me., capital $1,000,000. Promotors: Ernest L. McLean, E. M. Leavitt, R. A. Kittredge, all of Augusta.

Bailey Heating & Plumbing Co., Wilmington, Del., capital $100,000, to conduct a heating and plumbing business. Incorporators: G. O. Bailey, W. Alsentzer, G. M. Bailey and R. M. Burns, all of Wilmington.

J. F. Kincaid, Inc., Syracuse, N. Y., capital $30,000, to deal in heating and plumbing supplies. Incorporators: Leslie Kincaid, James F. Kincaid, R. L Kincaid and Andrew Tennant, all of Syracuse.

National Heating and Ventilating Co., Indianapolis, Ind., capital $5,000. Incorporators: Van B. Cones, John A. White and Ethel K. Swift.

Cincinnati Heating Co., Cincinnati, O., capital $10,000, to engage in a heating and plumbing contracting business. Incorpor-



Sirocco Multi-blade Fan Exhausting Kitchen Odors

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Multi-Blade Ventilating Fans

Can be used to great advantage in connection with cooling and exhausting odors from kitchen, smoke from club rooms, ventilating toilet and bath rooms.

They deliver twice the amount of air as the ordinary steel plate fan, hence require only **one-half** the space for the same duty.

Sirocco Multi-Blade Fans operate quietly and require **less power** to deliver the same amount of air when compared to the ordinary steel plate fan twice the diameter. They are easy to install and are nicely adapted to sheet metal work.

Our Discounts to Dealers, Contractors, and Sheet Metal Workers are attractive. Ask us about them.

AMERICAN BLOWER COMPANY

DETROIT. MICHIGAN. U.S.A.

Canada Sirocco Company, Limited
Windsor, Ont., Manufacturers for Canada

ators: Hugh C. Hara, M. Aaron, F. M. Bauman and H. Leich.

Dundee Plumbing Co., Omaha, Neb., capital $10,000. Incorporators: Charles A. Nelson and Walter L. Stewart.

Maginn Co., Chicago, Ill., capital $75,000, to manufacture heating and ventilating specialties. Incorporators: M. Maginn, A. Wagenfur and C. C. Spencer.

Central Boiler & Sheet Iron Works, Indianapolis, Ind., capital $10,000, to manufacture boilers and tanks. Incorporators: F. J. Schneider, M. P. Herter and M. N. Schneider.

Stoetzel Blower Co., Wellsville, N. Y., capital $250,000, to manufacture blowers and pumps. Incorporators: E. G. Rathbone, Sr., Wellsville; J. J. Stoetzel and W. W. Dinspel, New York.

Utility Valve Co., Spokane, Wash., capital $1,000,000, to manufacture a patented electric control valve for heating and water supply systems, whereby such valves may be opened or closed from a distance.

Utica Plumbing & Supply Co., Utica, N. Y., capital $100,000, to manufacture and deal in heating and plumbing supplies. Incorporators: Guy S. Donahue, Walter W. Corp and Rupert A. Tate. The officers are: President and general manager, Rupert A. Tate; vice-president, Guy S. Donahue; treasurer, Walter A. Corp; secretary, Hoyt L. Jamieson.

Rovner Bros. Plumbing Co., Akron, O., capital $10,000, to conduct a heating and plumbing business. Incorporators: S. M. Davis, E. A. Close, E. E. Rodd, H. A. Beckerman and W. D. Cole.

McKay-Navarre Plumbing & Heating Co., Seattle, Wash., capital $6,000. Incorporators: Walter C. McKay, I. G. Navarre and F. B. Harnett.

Sanitation Co., Cleveland, O., capital $25,000, to conduct a heating and plumbing business. Incorporators: E. B. Merriam, J. S. Bell, J. B. Waterworth, C. R. Alburn and L. B. Parks.

H. H. Highlands Co., Gary, Ind., capital $4,000, to take over the heating and plumbing business of H. H. Highlands. Incorporators: H. H. Highlands, Hubert F. Highlands and I. E. Kidwell.

J. F. Dunn Contracting Co., Rochester, N. Y., capital $5,000, to conduct a heating and plumbing business. Incorporators: John F. Dunn, G. L. Dunn and Henry L. Braun, all of Rochester.

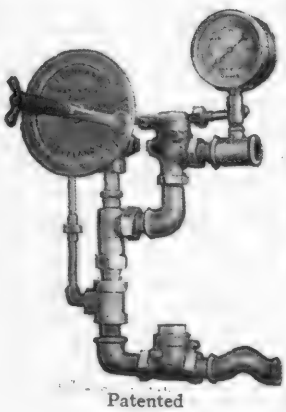
New Firms and Business Changes.

Lewis & Kitchen Corporation, Chicago, Ill., has been organized by Samuel C. Lewis to conduct an engineering and contracting business in heating and ventilating work. The company has taken quarters at 900 Karpen building. Mr. Lewis was formerly vice-president of the Lewis & Kitchen Co.

A. F. Vollette Co., Grand Rapids, Mich., is the title of a new heating and plumbing business organized by A. F. Vollette. The new company is located in the TenHopen Building, at Lake Drive and Robinson Road.

Central Heating & Plumbing Co., Exeter, N. H., has been organized to take over the business of Augustus Young. The new proprietors are John J. Smith, George H. Stackpole and Albert S. Willey, all of whom were formerly connected with Mr. Young. Quarters have been established at 25 Water St., Exeter, and also at Hampton.

Jesse Coogan Engineering Co., Salt Lake City, Utah, has opened a large establishment in that city for designing, engineering and contracting for heating and ventilating apparatus exclusively. The company will specialize in installations of the Coogan system of hot water heating and the Coogan system of natural ventilation. The company is now installing the largest hot


Patented

Automatic Water Driven Air Exhauster for Air Line Vacuum Heating Systems

CREATES and antomatically maintains a vacuum in the air piping leading from air valves. Rapid, silent and uniform circulation of steam throughout entire radiation is procured, with the great expansion peculiar to vacuum space.

The Air Exhauster is very simple, has bronze diaphragms, no wearing parts, does not require packing, and will last a lifetime.

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Multivane Fans

WHEN a Sturtevant Engineer specifies a Sturtevant Multivane Fan to fulfill definite specifications, the purchaser may rest assured that the conditions will actually be filled. There will be no come-back, nor changing or strengthening of the fan after installation.

A fan of whatever make delivers air only up to its capacity regardless of the method of test. Sturtevant fans actually deliver the volume claimed for them.

The customer's protection is guaranteed by the largest builders of fans, fan systems and allied products in the world.

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B. F. STURTEVANT COMPANY

HYDE PARK, BOSTON, MASSACHUSETTS - and all principal cities of the world

water heating system west of Chicago for the Harriman system in seven new shop buildings and in a 40-stall roundhouse at Pocatello, Idaho. The company maintains an office in Milwaukee, Wis., in the Engineering Building, 133 Second St., but Mr. Coogan will devote his entire time and attention to the Salt Lake City establishment. Jesse Coogan is chief engineer for the company, and Pomeroy Spencer superintendent.

Business Chances.

Jackson, Mich.—Bids will soon be asked for the new $150,000 hospital to be built at Jackson by St. Mary's Roman Catholic Church. The architects are Donaldson & Meier, Detroit, Mich.

Worcester, Mass.—An item of $15,000 is included in the budget of the Worcester County Commissioners for the installation of a heating and ventilating plant in the Worcester County School at Oakdale.

Detroit, Mich.—The Michigan Central Railroad is planning to build a new freight depot at West Jefferson and Third Streets, Detroit, to cost $500,000.

Detroit, Mich.—A new court house, to cost $1,500,000, is being planned for Detroit. The building will be nine stories high.

Washington, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, for the following-named work:

Until March 17, 1914, for the construction complete, including mechanical equipment, etc., of the U. S. Post Office and Court House at Minot, N. D. Three stories and basement; ground area, 6,700 sq. ft.

Until March 23, 1914, for air washers and humidity control apparatus in the U. S. Post Office (new) at St. Louis, Mo.

Until March 30, 1914, for the construction complete, including mechanical equipment, etc., of the U. S. Post Office at Urbana, Ill. Two stories and basement, 5,500 sq. ft. ground area.

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Until April 3, 1914, for the construction complete, including mechanical equipment, etc., of the U. S. Post Office at Sycamore, Ill. One story and basement, 3,800 sq. ft. ground area.

Contracts Awarded.

F. A. Buck Co., Eastport, Me., heating and ventilating and plumbing new school building, in that city, for $4,669.34 (for the heating and ventilating) and $1,450.72 (for the plumbing). Other bids for the heating and ventilating were received from Willey & Calhoun, Arthur B. Fells & Co., and W. W. Carman, all of Portland, Me., and from

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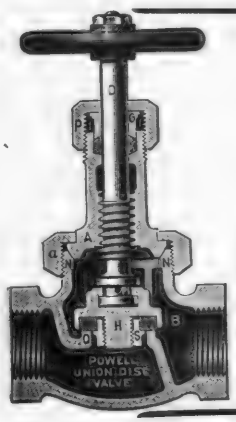

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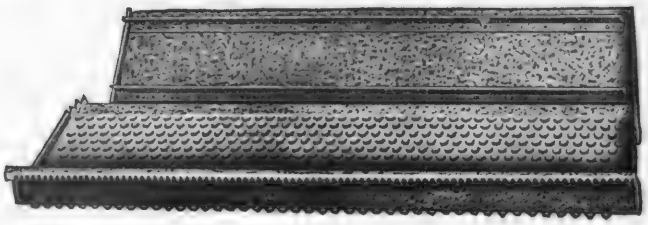

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E. S. Martin & Son Co. and E. F. Heffron, of Eastport.

J. J. Shamrock, Scranton, Pa., heating and ventilating high school at Ithaca, N. Y., for $14,875. The successful bidder was formerly the foreman for Lewis & Kitchen of Chicago, which firm had the original contract. An additional bid was received from Dean & Ferguson, of Ithaca, for $14,973.

Electric Service Co., Tacoma, Wash, ventilating Melbourne and Circuit Theatres on Pacific Avenue, Tacoma, for $2,500. Each installation will consist of an 8-ft. electric exhaust fan located on the roof, running at 2,000 R. P. M., effecting an air change every three minutes.

James Smyth Plumbing Co., Spokane, Wash., heating the new terminal station of the Oregon-Washington Railroad & Navigation Co. and the Chicago, Milwaukee & St. Paul Railroad. The heating and power plant contract amounts to $42,000.

Wm. H. Conklin Co., Columbus, O., completing the heating and ventilation of the new high school building at Sandusky, O., on the contract formerly held by the Lewis & Kitchen Co., Chicago.

Walter Schnbly, Normal, Ill., heating Presbyterian Church at Normal for $2,140.

Grambs & Peet, Glendive, Mont., heating and ventilating and plumbing of the new Washington School at Glendive, for $10,107. Other bids were received from the Glendive Heating & Plumbing Co., $11,800; and from Claude R. Cole, $12,300. The successful bidder for the vacuum cleaning system was Claude R. Cole, of Glendive, at his bid of $625. Other bids for the vacuum cleaning system were as follows: Glendive Heating & Plumbing Co., $718; Grambe & Peet, $724 and $793 (two bids).

Des Moines, Ia.—Bids for the heating and ventilating and plumbing for the North Des Moines High School building were received as follows: M. J. Corcoran, $27,770; Pray & Comerford, $32,804; McCauley Plumbing Co., $29,804; Walker Plumbing Co., $29,873; Des Moines Plumbing & Heating Co., $34,734; Wallace & Linane, $30,700; Bailey & Preppard, $29,233; Progressive Heating Co., $31,150; Globe Heating and Plumbing Co., $33,950.

America Heating Co., Rockford, Ill., completing the heating and ventilating work of the new high school building at Rockford, Ill., for $21,000. It was necessary to re-let the heating and plumbing contracts for this work, owing to the failure of the Evans Plumbing & Heating Co.

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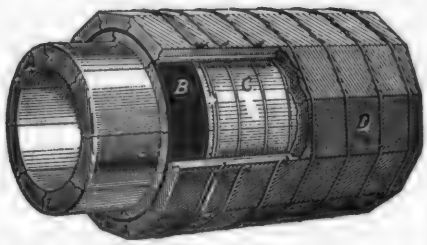

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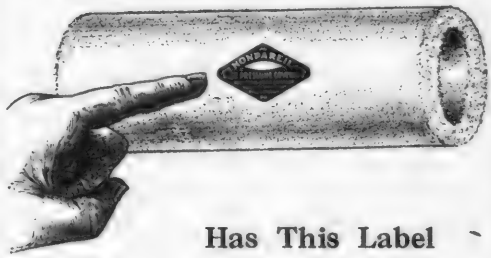

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Samuel A. Esswein Co., Columbus, O., heating and ventilating new $200,000 McClain School at Greenfield, O., William B. Ittner, architect.

John Obermeyer, Iron Mountain, Mich., heating and ventilating new school gymnasium at Chrystal Falls, for $3,000; also, heating city hall at Chrystal Falls, for $5,200.

William Steele & Sons Co., Philadelphia, general contract, including heating and sprinkler systems, for a group of factory buildings at Stenton Avenue and Louden Street, Wayne Junction, for H. G. Fetterolf, carpet manufacturer. The amount of the contract is $225,000, which includes a power plant.

Bartholomew Bros., Zanesville, O., heating and ventilating new school building at Zanesville, for $10,593.

Albert D. Franklin Co., Boston, Mass., heating new Y. M. C. A. building at Hartford, Conn.

Strublo Plumbing Co., Youngstown, O., heating and plumbing store and warehouse of Lytle, Morrow & Wentz at Youngstown.

J. P. Adamson, St. Paul, Minn., heating and plumbing new State Sanitorium at Walker, Minn.; also heating and ventilating new high school at Montevideo, Minn., North St. Paul; and heating and plumbing Carlton County jail.

Huffman-Conklin Co., Columbus, O., heating and ventilating and plumbing Bowling Green Normal School at Bowling Green, for $14,590. Other bids were: S. A. Esswein Co., Columbus, $16,150; Fitzpatrick & Hoepfner, Columbus, $18,833; Bryce Heating and Ventilating Co., Toledo, $9,032 (heating only); Cary & Hall, Defiance, $11,768 and $12,448 (two systems of heating and ventilating) and $7,810 (plumbing); and Eagen Bros Co., Toledo, O., $17,192.

C. F. Higgins, Pittsburg, Pa., heating and ventilating Watt Street School in Pittsburg.

Patterson & Jarrett, Springfield, Mo., hot water heating Y. M. C. A. building at that place.

Pittelkow Heating & Engineering Co., Detroit, Mich., steam heating 8-story Gregory, Mayer & Thom Building on Cadillac Square, Detroit.

Adams & Moffat Heating Co., Seattle, Wash., heating and ventilating and vacuum cleaning systems in the new Pantages Theatre at Winnipeg; also a similer installation in the Pantages Theatre in Victoria, B. C. The company is preparing plans for

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CHAPTER III—PIPE LINE DESIGN IN GENERAL

Hot Water System. Steam System. Steam System (Return). Percentage of Line Loss. Map of One-Pipe Steam System. Map of Two-Pipe Steam System. Map of Multiple Water System. Map of Belt Water System. Comparison of Systems. Tunnel and Conduit Construction. Notes on Construction. Notes on Repaving.

CHAPTER IV—RATES IN GENERAL

Temperature Control. Heat Consumption Tables. Heat Pro-Rating Table. Maximum Demand Rate. Fixed Charges; Operating Costs.

CHAPTER V—THE HEATING STATION

Steam Systems. Water Systems. Boilers. Pumps. Reheaters.

CHAPTER VI—OPERATION AND MAINTENANCE

Pressure Required in Heating Mains. Pressure Required in Hot Water Mains. Regulating Flow of Water. Temperature Required in Hot Water Heating Mains. Schedule of Temperatures. Notes on Maintenance. Pipe Line. Station. Traps, Meters, etc. Percentage of First Cost.

CHAPTER VII—MANAGEMENT

Notes in General. New Business Department.

CHAPTER VIII—FRANCHISES

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CHAPTER IX—BUILDING EQUIPMENT IN GENERAL

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Vinton & Co., Detroit, Mich., general contract, including the heating and plumbing, for the building of the Detroit Athletic Club. The contract amounts to $750,000.

Lamneck Co., Columbus, O., heating and ventilating George Wahlenma picture theatre at North High and Goodale Streets, Dusenbury picture theatre on Mt. Vernon Avenue; also heating and ventilating Murray City School and town hall at Carroll.

McGinness Co., Pittsburg, Pa., heating and ventilating Elizabeth Steel Magee Hospital at Pittsburg. The installation will include three 150 H. P. return tubular boilers.

Worcester, Mass.—Bids were received as follows for the steam heating and ventilating of the Andover Street School: Nicholas J. Smith, Worcester, $4,015; Central Supply Co., $4,690; M. B. Holmes & Sons Co., $4,392; J. W. Callahan & Sons, $4,330; O. S. Kendall & Son, $4,289; Edwin Hawes Co., $4,101.

Lincoln, Neb.—Bids were received as follows for the heat regulating systems for the High and Bancroft School buildings at Lincoln: Johnson Service Co., $10,370; National Regulator Co., $9,875; Thorpe Regulator Co., $9,170.

Hanley-Casey Co., Chicago, Ill., heating and ventilating State Capitol at Jefferson City, Mo., for $200,000.

Jones Bros., Central Valley, N. Y., steam heating McKenzie Preparatory School, at Monroe, N. Y., for $3,500.

Thomas Rheinhart, Le Mars, Ia., heating and plumbing new Normal School building at Wayne, Neb., for $4,830.

Vanderbilt & Williams, Auburn, Cal., steam heating county court house at Auburn, for $5,315.

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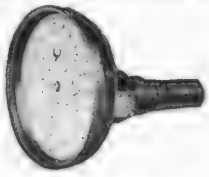

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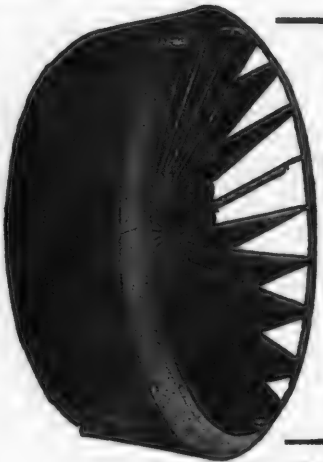

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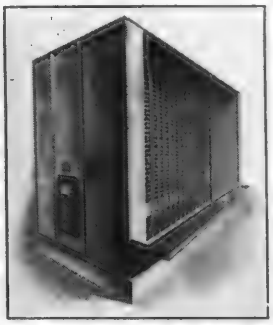

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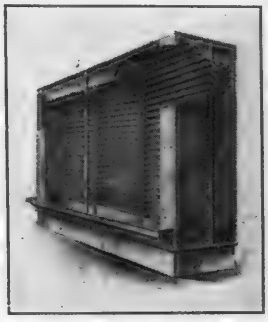

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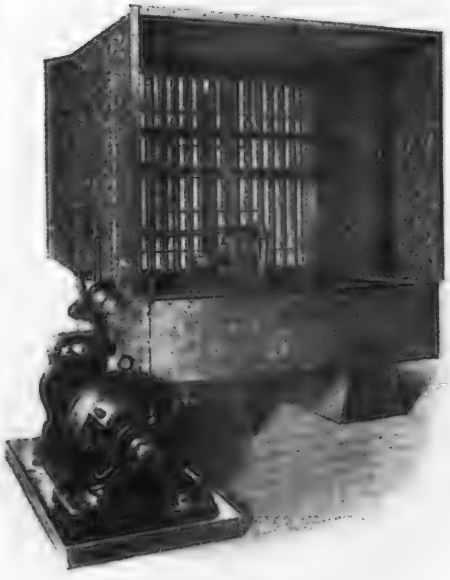

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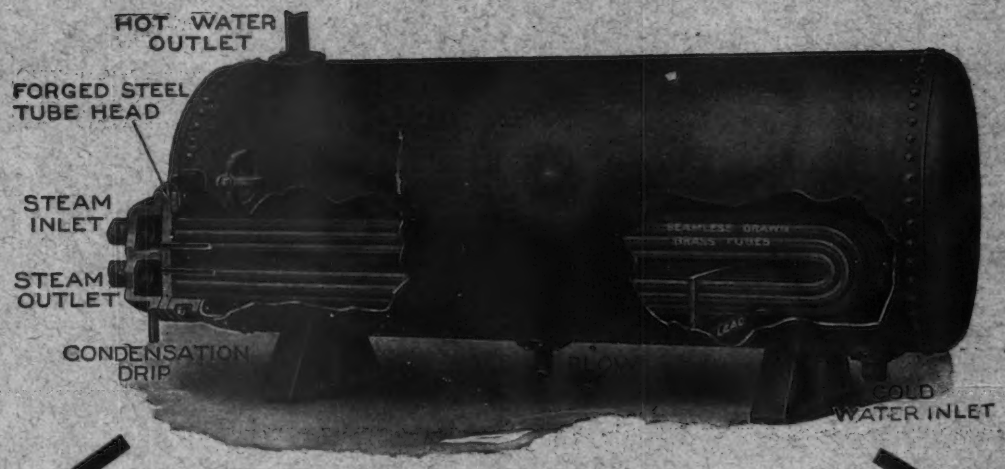

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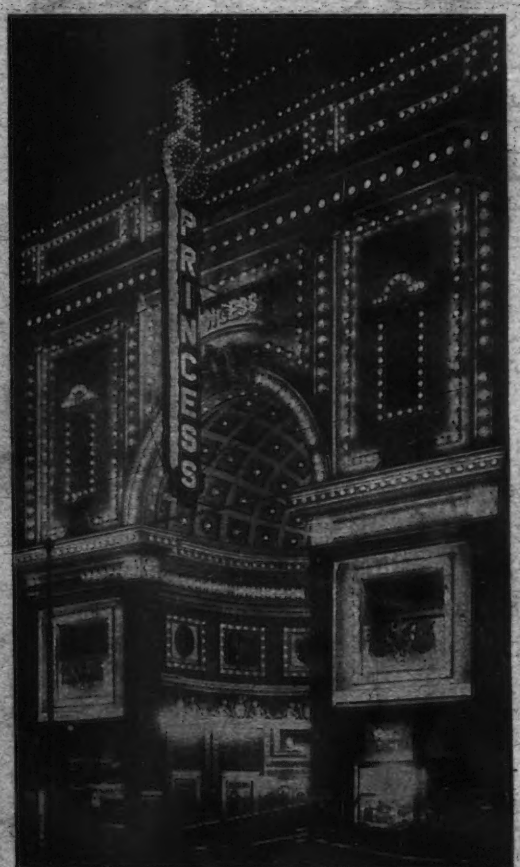

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